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SESSIONAL PAPERS

THIRD SESSION, FOURTEENTH PARLIAMENT

OF THE

PROVINCE OF BRITISH COLUMBIA

SESSION 1919

VOLUME TWO

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
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ANNUAL REPORT

OF THE

MINISTER OF MINES

FOR THE

YEAR ENDING 31ST DECEMBER

1918

BEING AN ACCOUNT OF

MINING OPERATIONS FOR GOLD, COAL, ETC.

IN THE

PROVINCE OF BRITISH COLUMBIA

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mining Industry of the Province for the year 1918 is herewith respectfully submitted.

WILLIAM SLOAN,
Minister of Mines.

Minister of Mines' Office,
February 28th, 1919.

Canada Copper Corporation's Concentrator, under construction at Allenby, Copper Mt.

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To the Honourable William Sloan,
Minister of Mines.

SIR,—I have the honour to submit herewith my Annual Report on the Mining Industry of the Province for the year ending December 31st, 1918.

The statistical tables give the total mineral output of the Province to date, and show in considerable detail the actual mineral production of the past year, as based on smelter or mill returns; also, a summary of the production of each of the last four years, thus illustrating by comparison the progress made in productive mining during this period.

To facilitate comparison with information previously given, I have retained, as closely as was possible, the general form already established for such tables and for the Report.

I have the honour to be,

Sir,

Your obedient servant,

WILLIAM FLEET ROBERTSON,

Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,
February 28th, 1919.

MINERAL PRODUCTION OF BRITISH COLUMBIA.

METHOD OF COMPUTING PRODUCTION.

In assembling the output of the lode mines in the following tables, the established custom of this Bureau has been adhered to, viz.: The output of a mine for the year is considered that amount of ore for which the smelter or mill returns have been received during the year. This system does not give the exact amount mined during the year, but rather the amount credited to the mine on the company's books during such year.

For ore shipped in December the smelter returns are not likely to be received until February in the new year, or later, and have, consequently, to be carried over to the credit of such new year. This plan, however, will be found very approximate for each year, and ultimately correct, as ore not credited in one year is credited in the next.

In the lode mines tables, the amount of the shipments has been obtained from certified returns received from the various mines, as provided for in the "Inspection of Metalliferous Mines Act, 1897." In calculating the value of the products, the average prices for the year in the New York Metal Market have been used as a basis. For silver 95 per cent., for lead 90 per cent., and for zinc 85 per cent. of such market prices have been taken. Treatment and other charges have not been deducted, except that in copper the amount of metal actually recovered has been taken, thus covering loss in slags.

TABLE I.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1918.

Gold, placer	$ 75,436,103
Gold, lode	97,121,786
Silver	46,839,631
Lead	42,294,251
Copper	145,741,069
Zinc	13,278,058
Coal and coke	187,147,652
Building-stone, bricks, etc.	28,843,272
Miscellaneous minerals, etc	651,759
Total	$637,353,581

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1918 (INCLUSIVE).

1852 to 1892 (inclusive)	$ 81,090,069
1893	3,588,413
1894	4,225,717
1895	5,643,042
1896	7,507,956
1897	10,455,268
1898	10,906,861
1899	12,393,131
1900	16,344,751
1901	20,086,780
1902	17,486,550
1903	17,495,954
1904	18,977,359
1905	22,461,325
1906	24,980,546
1907	25,882,560
1908	23,851,277
1909	24,443,025
1910	26,377,066
1911	23,499,072
1912	32,440,800
1913	30,296,398
1914	26,388,825
1915	29,447,508
1916	42,290,462
1917	37,010,392
1918	41,782,474
Total	$637,353,581

Table III. gives a statement in detail of the quantities and value of the different mineral products for the years 1916, 1917, and 1918. It is difficult to get absolutely complete statistics regarding building-stone, lime, bricks, tiles, and other miscellaneous products, but the detail figures shown in Table V. are as nearly accurate as can be obtained.

TABLE III.

QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1916, 1917, AND 1918.

	Customary Measure.	1916.		1917.		1918.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold placer	Ounces.	29,025	$ 580,500	24,800	$ 496,000	16,000	$ 320,000
" lode	"	221,932	4,587,334	114,523	2,367,190	164,674	3,403,812
Silver	"	3,301,923	2,059,739	2,929,216	2,265,749	3,498,172	3,215,870
Lead	Pounds	48,727,516	3,007,462	37,307,465	2,951,020	43,899,661	2,928,107
Copper	"	65,379,364	17,784,494	59,007,565	16,038,256	61,483,754	15,143,449
Zinc	"	37,168,980	4,043,985	41,848,513	3,166,259	41,772,916	2,899,040
Coal	Tons, 2,240 lb.	2,084,093	7,294,325	2,149,975	7,524,913	2,302,245	11,511,225
Coke	" "	267,725	1,606,350	159,905	959,430	188,967	1,322,769
Miscellaneous products			1,326,273		1,241,575		1,038,202
			$42,290,462		$37,010,392		$41,782,474

TABLE IV.

OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

NAMES.	DIVISIONS.			DISTRICTS.		
	1916.	1917.	1918.	1916.	1917.	1918.
CARIBOO DISTRICT				$ 778,157	$ 529,897	$ 383,996
Cariboo Mining Division	$ 162,000	$ 137,756	$ 62,500			
Quesnel "	20,000	15,000	21,000			
Omineca "	596,157	377,141	300,496			
CASSIAR DISTRICT				7,210,949	8,485,438	9,178,441
EAST KOOTENAY DISTRICT				6,810,926	5,056,782	7,259,897
WEST KOOTENAY DISTRICT				9,101,905	5,972,545	6,113,279
Ainsworth Division	754,902	750,514	663,388			
Slocan and Slocan City "	3,761,091	3,554,055	3,675,762			
Nelson "	619,376	403,436	396,697			
Trail Creek "	3,935,836	1,197,283	1,357,571			
Other parts	30,700	67,257	19,861			
BOUNDARY-YALE DISTRICT				7,243,560	5,055,403	4,961,452
Osoyoos, Grand Forks, and Greenwood Divisions	6,592,991	4,253,965	3,897,826			
Similkameen, Nicola, Vernon	450,780	571,300	909,869			
Yale, Ashcroft, Kamloops	199,789	230,138	153,757			
LILLOOET DISTRICT				65,457	73,175	57,746
COAST DISTRICT (Nanaimo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver)				11,079,508	11,837,152	13,827,663
				$42,290,462	$37,010,392	$41,782,474

TABLE V.

Miscellaneous Products and Totals of Production, 1918.

District and Division.	Cement.	Lime and Limestone.	Building-stone.	Riprap.	Crushed Rock, Flux.	Sand and Gravel.	Pottery and Clay.	Fire, Face, and Red Brick.	Total Building Materials.	Miscellaneous Minerals.	Total Miscellaneous Products.	Total Output of Collieries.	Total of Metalliferous Minerals.	Totals for Divisions	Totals for Districts.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Cariboo															383,996
Cariboo		1,000			1,000	500			2,500		2,500		60,000	62,500	
Quesnel					500	500			1,000		1,000		20,000	21,000	
Omineca		500			500	500			1,500	2,400	3,900	2,350	294,246	300,496	
Cassiar															9,178,441
Atlin, Stikine-Liard													233,493	233,493	
Skeena, Nass River, Portland Canal, Queen Charlotte					129,891	1,000	2,625		133,516		133,516		8,811,432	8,944,948	
East Kootenay															7,259,897
Fort Steele		500			1,000	500			2,000	21,670	23,670	3,631,345	3,342,136	6,997,151	
Windermere-Golden					500	500			1,000		1,000		261,746	262,746	
West Kootenay															6,113,279
Ainsworth					500	500			1,000		1,000		662,388	663,388	
Slocan & Slocan City					500	500			1,000		1,000		3,674,762	3,675,762	
Nelson & Arrow Lake		1,000	20	1,000	1,075	2,014		2,400	7,509		7,509		389,188	396,697	
Trail Creek		500			1,000	1,000			2,500		2,500		1,355,071	1,357,571	
Other Divisions		500			500	500			1,500		1,500		18,361	19,861	
Boundary-Yale															4,961,452
Grand Forks, Greenwood, Osoyoos		1,000		1,000	23,257	1,000	809		27,066	65,391	92,457		3,805,369	3,897,826	
Similkameen, Nicola, Vernon		1,000	225	1,000	1,000	1,000		1,670	5,895		5,895	895,895	8,079	909,869	
Yale, Ashcroft, Kamloops		1,000		1,000	1,000	1,000		1,200	5,200		5,200		148,557	153,757	
Lillooet					500	500			1,000	4,250	5,250		52,496	57,746	57,746
Coast District	288,526	21,536	4,192	5,520	24,614	47,524	69,951	284,842	746,705	3,600	750,305	8,304,404	4,772,954	13,827,663	13,827,663
Totals	288,526	28,536	4,437	9,520	187,337	59,038	73,385	290,112	940,891	97,311	1,038,202	12,833,994	27,910,278	41,782,474	41,782,474

TABLE VI.—PLACER GOLD.

Table VI. contains the yearly production of placer gold to date, as determined by the returns sent in by the banks and express companies, of gold transmitted by them to the mints, and from returns sent in by the Gold Commissioners and mining Recorders. To these yearly amounts one-third was added up to the year 1878; from then to 1895 and from 1898 to 1909, one-fifth; and since then one-tenth, which proportions are considered to represent, approximately, the amount of gold sold of which there is no record. This placer gold contains from 10 to 25 per cent. silver, but the silver value has not been separated from the totals, as it would be insignificant.

YIELD OF PLACER GOLD TO DATE.

1858	$ 705,000	1874	$1,844,618	1889	$ 588,923	1904	$1,115,300
1859	1,615,070	1875	2,474,004	1890	490,435	1905	969,300
1860	2,228,543	1876	1,786,648	1891	429,811	1906	948,400
1861	2,666,118	1877	1,608,182	1892	399,526	1907	828,000
1862	2,656,903	1878	1,275,204	1893	356,131	1908	647,000
1863	3,913,563	1879	1,290,058	1894	405,516	1909	477,000
1864	3,735,850	1880	1,013,827	1895	481,683	1910	540,000
1865	3,491,205	1881	1,046,737	1896	544,026	1911	426,000
1866	2,662,106	1882	954,085	1897	513,520	1912	555,500
1867	2,480,868	1883	794,252	1898	643,346	1913	510,000
1868	3,372,972	1884	736,165	1899	1,344,900	1914	565,000
1869	1,774,978	1885	713,738	1900	1,278,724	1915	770,000
1870	1,336,956	1886	903,651	1901	970,100	1916	580,500
1871	1,799,440	1887	693,709	1902	1,073,140	1917	496,000
1872	1,610,972	1888	616,731	1903	1,060,420	1918	320,000
1873	1,305,749						
				Total			$75,436,103

TABLE VII.—PRODUCTION OF LODE MINES.

YEAR.	GOLD.		SILVER.		LEAD.		COPPER.		ZINC.		TOTAL VALUE.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
		$		$		$		$		$	$
1887	.....	.....	17,690	17,331	204,800	9,216	.....	.....	.....	.....	26,547
1888	.....	.....	79,780	75,000	674,500	29,813	.....	.....	.....	.....	104,813
1889	.....	.....	53,192	47,873	165,100	6,498	.....	.....	.....	.....	54,371
1890	.....	.....	70,427	73,948	*Nil.*	*Nil.*	.....	.....	.....	.....	73,948
1891	.....	.....	4,500	4,000	*Nil.*	*Nil.*	.....	.....	.....	.....	4,000
1892	.....	.....	77,160	66,935	808,420	33,064	.....	.....	.....	.....	99,999
1893	1,170	23,404	227,000	195,000	2,135,023	78,996	.....	.....	.....	.....	297,400
1894	6,252	125,014	746,379	470,219	5,662,523	169,875	324,680	16,234	.....	.....	781,342
1895	39,264	785,271	1,496,522	977,229	16,475,464	532,255	952,840	47,642	.....	.....	2,342,397
1896	62,259	1,244,180	3,135,343	2,100,689	24,199,977	721,384	3,818,556	190,926	.....	.....	4,257,179
1897	106,141	2,122,820	5,472,971	3,272,836	38,841,135	1,390,517	5,325,180	266,258	.....	.....	7,052,431
1898	110,061	2,201,217	4,292,401	2,375,841	31,693,559	1,077,581	7,271,678	874,781	.....	.....	6,529,420
1899	138,315	2,857,573	2,939,413	1,663,708	21,862,436	878,870	7,722,591	1,351,453	.....	.....	6,751,604
1900	167,153	3,453,381	3,958,175	2,309,200	63,358,621	2,691,887	9,997,080	1,615,289	.....	.....	10,069,757
1901	210,384	4,348,603	5,151,333	2,884,745	51,582,906	2,002,733	27,603,746	4,446,963	.....	.....	13,683,044
1902	236,491	4,888,269	3,917,917	1,941,328	22,536,381	824,832	29,636,057	3,446,673	.....	.....	11,101,102
1903	232,831	4,812,616	2,996,204	1,521,472	18,089,283	689,744	34,359,921	4,547,535	.....	.....	11,571,367
1904	222,042	4,589,608	3,222,481	1,719,516	36,646,244	1,421,874	35,710,128	4,578,037	.....	.....	12,309,035
1905	238,660	4,933,102	3,439,417	1,971,818	56,580,703	2,399,022	37,692,251	5,876,222	.....	.....	15,180,164
1906	224,027	4,630,639	2,990,262	1,897,320	52,408,217	2,667,578	42,990,488	8,288,565	.....	.....	17,484,102
1907	196,179	4,055,020	2,745,448	1,703,825	47,738,703	2,291 458	40,832,720	8,166,544	.....	.....	16,216,847
1908	255,582	5,282,880	2,631,389	1,321,483	43,195,733	1,632,799	47,274,614	6,240,249	.....	.....	14,477,411
1909	238,224	4,924,090	2,532,742	1,239,270	44,396,346	1,709,259	45,597,245	5,918,522	8,500,000	400,000	14,191,141
1910	267,701	5,533,380	2,450,241	1,245,016	34,658,746	1,386,350	38,243,934	4,871,512	4,184,192	192,473	13,228,731
1911	228,617	4,725,513	1,892,364	958,293	26,872,397	1,069,521	36,927,656	4,571,644	2,634,544	129,092	11,454,063
1912	257,496	5,322,442	3,132,108	1,810,045	44,871,454	1,805,627	51,456,537	8,408,513	5,358,280	316,139	17,662,766
1913	272,254	5,627,490	3,465,856	1,968,606	55,364,677	2,175,832	46,460,305	7,094,489	6,758,768	324,421	17,190,838
1914	247,170	5,109,004	3,602,180	1,876,736	50,625,048	1,771,877	45,009,699	6,121,319	7,866,467	346,125	15,225,061
1915	250,021	5,167,934	3,366,506	1,588,991	46,503,590	1,939,200	56,918,405	9,835,500	12,982,440	1,460,524	19,992,149
1916	221,932	4,587,334	3,301,923	2,059,739	48,727,516	3,007,462	65,379,364	17,784,494	37,168,980	4,043,985	31,483,014
1917	114,523	2,367,190	2,929,216	2,265,749	37,307,465	2,951,020	59,007,565	16,038,256	41,848,513	3,166,259	26,788,474
1918	164,674	3,403,812	3,498,172	3,215,870	43,899,661	2,928,107	61,483,754	15,143,449	41,772,916	2,899,040	27,590,278
To'l	4,709,423	97,121,786	79,836,712	46,839,631	968,086,628	42,294,251	837,996,994	145,741,069	169,075,100	13,278,058	345,274,795

TABLE VIII.—COAL AND COKE PRODUCTION PER YEAR TO DATE.

COAL.

Year.	Tons (2,240 lb.).	Value.
1836-1881	1,873,907	$ 6,003,245
1882	282,139	846,417
1883	213,299	639,897
1884	394,070	1,182,210
1885	265,596	796,788
1886	326,636	979,908
1887	413,360	1,240,080
1888	489,301	1,467,903
1889	579,830	1,739,490
1890	678,140	2,034,420
1891	1,029,097	3,087,291
1892	826,335	2,479,005
1893	978,294	2,934,882
1894	1,012,953	3,038,859
1895	939,654	2,818,962
1896	896,222	2,688,666
1897	882,854	2,648,562
1898	1,135,865	3,407,595
1899	1,306,324	3,918,972
1900	1,439,595	4,318,785
1901	1,460,331	4,380,993
1902	1,397,394	4,192,182
1903	1,168,194	3,504,582
1904	1,253,628	3,760,884
1905	1,384,312	4,152,936
1906	1,517,303	4,551,909
1907	1,800,067	6,300,235
1908	1,677,849	5,872,472
1909	2,006,476	7,022,666
1910	2,800,046	9,800,161
1911	2,193,062	7,675,717
1912	2,628,804	9,200,814
1913	2,137,483	7,481,190
1914	1,810,967	6,338,385
1915	1,611,129	5,638,952
1916	2,084,093	7,294,325
1917	2,149,975	7,524,913
1918	2,302,245	11,511,225
Total	49,346,829	$164,476,478

COKE.

Year.	Tons (2,240 lb.).	Value.
1895-97	19,396	$ 96,980
1898 (estimated)	35,000	175,000
1899	34,251	171,255
1900	85,149	425,745
1901	127,081	635,405
1902	128,015	640,075
1903	165,543	827,715
1904	238,428	1,192,140
1905	271,785	1,358,925
1906	199,227	996,135
1907	222,913	1,337,478
1908	247,399	1,484,394
1909	258,703	1,552,218
1910	218,029	1,308,174
1911	66,005	396,030
1912	264,333	1,585,998
1913	286,045	1,716,270
1914	234,577	1,407,462
1915	245,871	1,475,226
1916	267,725	1,606,350
1917	159,905	959,430
1918	188,967	1,322,769
Total	3,964,337	$22,671,174

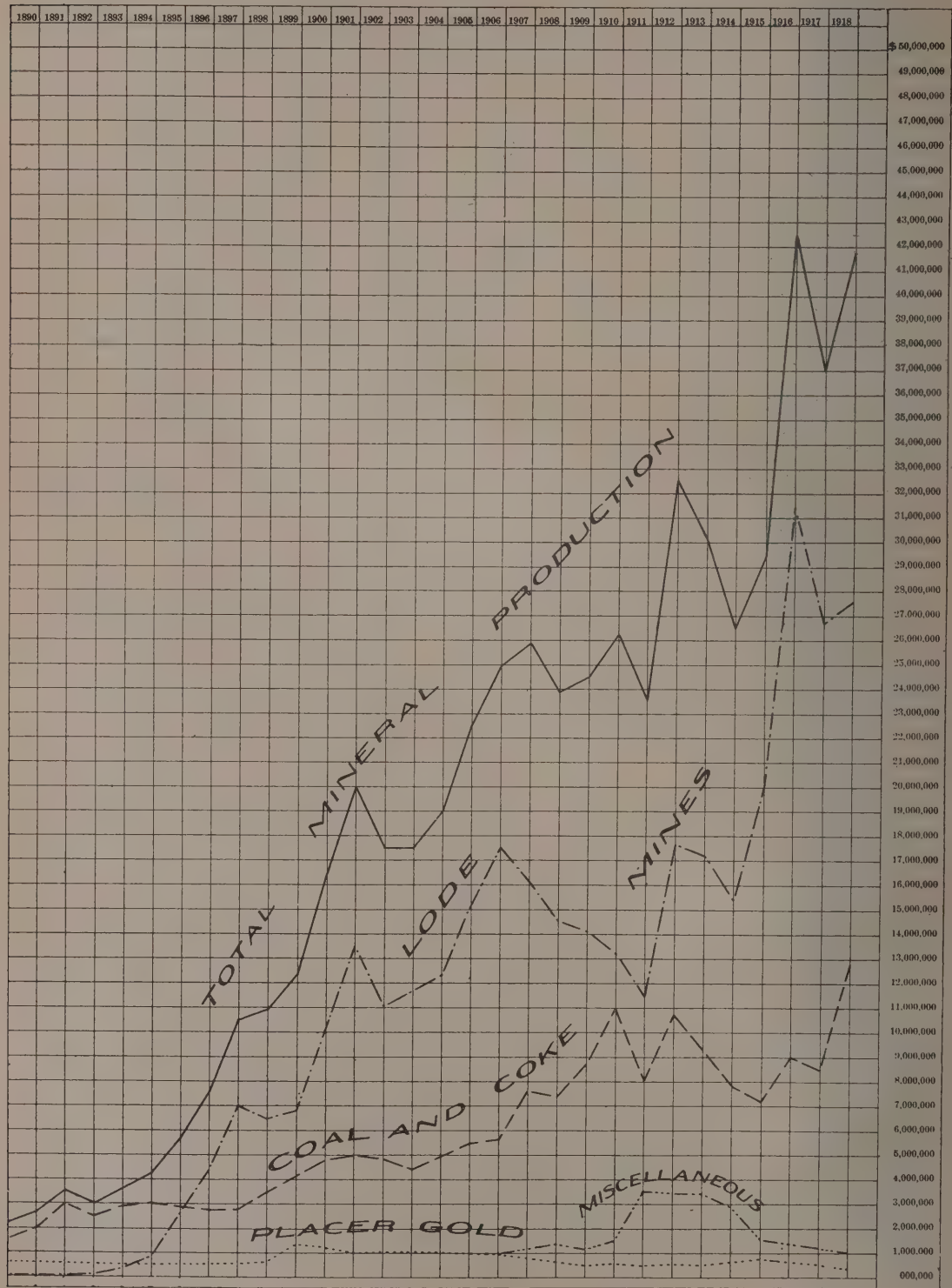
TABLE IX.—PRODUCTION IN DETAIL OF THE

DISTRICT.	YEAR	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
				$		$		$
Cariboo								
Cariboo and Quesnel Divisions	1915		15,000	300,000				
	1916		8,900	178,000				
	1917		7,500	150,000				
	1918		4,000	80,000				
Omineca Division	1915	17,545	600	12,000	1,524	31,501	79,155	37,361
	1916	17,752	850	17,000	1,303	26,933	112,635	70,262
	1917	4,159	600	12,000	931	19,244	82,311	63,668
	1918	6,956	400	8,000	985	20,360	84,125	77,336
Cassiar								
Atlin, Liard, and Stikine Divisions	1915	320	20,300	406,000	875	18,086		
	1916	262	18,025	360,500	736	15,213	3,054	1,905
	1917	33	15,600	312,000	1,000	20,670		
	1918	73	11,025	220,500	446	9,219	1,115	1,025
Skeena, Nass, Queen Charlotte, and Portland Canal Divisions.	1915	646,391			5,034	104,053	175,179	82,684
	1916	732,880			3,806	78,670	256,802	160,193
	1917	821,819			9,805	202,669	343,805	265,933
	1918	956,231			48,016	992,491	416,616	382,995
East Kootenay								
Fort Steele Division	1915	44,372	750	15,000			481,258	227,154
	1916	98,846	200	4,000			509,693	317,946
	1917	114,391	100	2,000			180,168	139,380
	1918	137,950	50	1,000			261,497	240,394
Windermere-Golden	1915	5,556					1,188	561
	1916	2,183					29,178	18,201
	1917	2,354					79,685	61,636
	1918	3,620					91,784	84,377
West Kootenay								
Ainsworth Division	1915	42,630			121	2,501	289,565	136,675
	1916	77,841			45	930	321,202	200,366
	1917	82,481			1	20	224,461	173,621
	1918	44,937			18	372	228,699	210,243
Slocan and Slocan City	1915	114,292			26	537	1,812,550	855,524
	1916	123,886			64	1,323	1,480,571	923,580
	1917	149,895			18	372	1,547,576	1,197,050
	1918	142,700			67	1,385	1,873,236	1,722,056
Nelson and Arrow Lake Divisions	1915	23,634	50	1,000	9,233	190,846	9,405	4,439
	1916	20,695	50	1,000	4,107	84,891	32,547	20,303
	1917	10,738	50	1,000	2,521	52,109	46,229	35,758
	1918	15,348	50	1,000	7,155	147,894	133,738	125,703
Trail Creek Division	1915	338,568			142,595	2,947,439	159,584	76,324
	1916	308,924			129,790	2,682,759	132,080	82,391
	1917	100,171			33,290	688,104	47,112	36,441
	1918	112,349			43,745	904,209	47,203	43,394
Revelstoke, Trout Lake and Lardeau	1915	155	100	2,000	15	310	16,740	7,901
	1916	521	50	1,000	22	455	22,419	13,985
	1917	534	50	1,000	62	1,282	37,733	29,187
	1918	255	50	1,000	35	723	11,761	10,812
Boundary-Yale								
(Grand Forks, Greenwood and Osoyoos Divisions.)	1915	1,228,724	100	2,000	87,870	1,816,273	273,795	129,231
	1916	1,343,853	50	1,000	75,628	1,563,231	280,578	175,025
	1917	779,345	50	1,000	58,544	1,210,104	220,213	170,335
	1918	692,504	50	1,000	55,353	1,144,147	227,113	208,785
Similkameen, Nicola, and Vernon Divisions	1915	225	600	12,000	101	2,088	347	164
	1916	1,416	450	9,000	32	661	830	518
	1917	1,384	400	8,000	111	2,294	3,470	2,684
	1918	73	250	5,000	1	21	131	120
Yale, Ashcroft and Kamloops Divisions	1915	2,134	500	10,000	106	2,191	1,702	803
	1916	7,414	150	3,000	570	11,782	4,215	2,629
	1917	8,254	100	2,000	1,355	28,008	3,525	2,727
	1918	30,823	50	1,000	815	16,843	1,317	1,211
Lillooet								
Lillooet and Clinton Divisions	1915	50	400	8,000	31	641	5	2
	1916	2,400	250	5,000	2,625	54,259		
	1917	4,700	300	6,000	3,092	63,912	276	213
	1918	3,858	50	1,000	2,473	51,117	412	379
Southern Coast								
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria Divisions.)	1915	12,304	100	2,000	2,092	43,242	15,727	7,423
	1916	15,771	50	1,000	2,382	49,236	17,954	11,200
	1917	19,221	50	1,000	2,813	58,145	25,727	19,900
	1918	13,269	25	500	2,515	51,985	23,040	21,181
Mainland (Vancouver and New Westminster Divisions).	1915	213,150			398	8,226	50,306	23,745
	1916	434,064			822	16,991	98,165	61,235
	1917	662,100			980	20,257	86,925	67,236
	1918	731,900			3,050	63,043	93,385	85,849
TOTALS	1915	2,690,110	38,500	770,000	250,021	5,167,934	3,366,506	1,588,991
	1916	3,188,865	29,025	580,500	221,932	4,587,334	3,301,923	2,059,739
	1917	2,761,579	24,800	496,000	114,523	2,367,190	2,929,216	2,265,749
	1918	2,892,849	16,000	320,000	164,674	3,403,812	3,498,172	3,215,870

METALLIFEROUS MINES, ETC., FOR 1915, 1916, 1917, AND 1918.

LEAD.		COPPER.		ZINC.		TOTALS FOR DIVISIONS.				TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1915.	1916.	1917.	1918.	1918.
	$		$		$	$	$	$	$	$
										374,246
						300,000				
							178,000			
								150,000		
									80,000	
249,279	10,395	2,831,279	489,245			580,502				
224,451	13,853	1,646,072	447,764	168,616	18,345		594,157			
271,885	21,506	852,373	231,675	364,097	27,548			375,641		
123,568	8,242	643,843	158,578	313,112	21,730				294,246	
										9,044,925
						424,086				
7,260	448						378,066			
								332,670		
		11,160	2,749						233,493	
30,462	1,270	21,915,481	3,786,995			3,975,002				
1,077	66	24,065,995	6,546,432				6,785,361			
		27,978,015	7,604,424					8,073,026		
		30,150,603	7,435,946						8,811,432	
										3,603,882
26,582,050	1,108,472			180,000	20,250	1,370,876				
24,156,143	1,490,917	5,654	1,538	14,840,000	1,614,592		3,428,993			
13,996,640	1,107,134	9,679	2,631	20,715,090	1,567,304			2,818,429		
18,695,565	1,243,994	1,763	435	26,704,806	1,853,313				3,342,136	
216,327	9,021			311,719	35,068	44,650				
571,244	35,257	3,400	925	210,000	22,848		77,231			
1,774,649	140,375	12,640	3,436	18,000	1,362			206,809		
2,655,210	177,369								261,746	
										6,099,770
3,436,184	143,289			678,940	76,381	358,846				
7,841,869	484,000			625,971	68,106		753,402			
6,395,350	505,872			918,601	69,501			749,014		
6,106,262	407,288			640,991	44,485				662,388	
14,925,345	622,387			8,684,572	977,014	2,455,462				
14,415,645	889,734			17,854,357	1,942,554		3,757,191			
11,808,019	934,014			18,789,573	1,421,619			3,553,055		
14,575,379	972,178	242	60	14,107,682	979,073				3,674,762	
967,775	40,356	30,240	5,225	3,127,209	351,811	593,677				
1,240,784	76,582	176,383	47,980	3,470,036	377,540		608,296			
2,605,666	206,108	50,946	13,847	982,309	74,322			383,144		
1,611,166	107,465	28,933	7,126						389,188	
		4,651,681	803,811			3,826,574				
		4,200,745	1,142,686				3,907,836			
		1,730,088	470,238					1,194,783		
		1,654,356	407,468						1,355,071	
89,041	3,713					13,924				
206,741	12,760						28,200			
395,321	31,270			33,279	2,518			65,257		
80,773	5,387			6,325	439				18,361	
										3,962,005
7,127	297	17,402,662	3,007,180			4,954,981				
14,922	921	17,626,623	4,794,794				6,534,971			
36,548	2,891	10,329,765	2,807,630					4,191,960		
47,738	3,184	9,940,125	2,448,253						3,805,369	
		21,701	3,750			18,002				
		182,633	49,680				59,859			
10,697	846	87 326	23,735					37,559		
		11,928	2,938						8,079	
		295,164	51,004			63,998				
47,380	2,924	636,594	173,166				193,501			
12,690	1,004	700,199	190,314	27,564	2,085			226,138		
		525,780	129,500						148,557	
										52,496
						8,643				
							59,259			
								70,125		
									52,496	
										4,772,954
		712,152	123,060			173,725				
		869,877	236,624				298,060			
		1,461,704	397,291					476,336		
		923,886	228,252						301,558	
		9,058,045	1,565,230			1,597,201				
		15,965,388	4,342,905				4,421,131			
		15,794,830	4,293,035					4,380,528		
		17,548,127	4,322,104						4,470,996	
46,503,590	1,939,200	56,918,405	9,835,500	12,982,440	1,460,524	20,762,149				
48,727,516	3,007,462	65,379,364	17,784,494	37,168,980	4,043,985		32,063,514			
37,307,465	2,951,020	59,007,565	16,038,256	41,848,513	3,166,259			27,284,474		
43,899,661	2,528,107	61,483,754	15,143,449	41,772,916	2,899,040				27,910,278	27,910,278

TABLE X.—SHOWING MINERAL PRODUCTION OF BRITISH COLUMBIA.



PROGRESS OF MINING.

The gross value of the mineral production for 1918 was $41,782,474, an increase from that of the year 1917 of $4,772,082, or 12.9 per cent. The gross value of the metallic minerals recovered in 1918 was $27,910,278, which represents an increase from last year of $625,804, a percentage increase of 2.3 per cent.

Only once in the history of the Province's mineral statistics has this output been exceeded, and that was in 1916, when the year's mineral-output amounted to $42,290,462, only 1.2 per cent. greater than 1918; and it must be remembered that 1916 was a phenomenal year, with metal prices temporarily inflated, due to war conditions. As compared with earlier years, the production of 1918 shows up even more favourably, for it exceeds the next highest recorded production—$32,440,800, made in 1912—by $9,341,674, or about 29 per cent.

As the value of the products of the metalliferous mines this year was only slightly greater than in the preceding year, the great increase made was therefore almost entirely attributable to the products of the collieries, which show outputs, both of coal and coke, exceeding those of the preceding year; the increased output of coal being some 152,270 tons, while that of coke was 28,062 tons.

In addition to this, the price of the coal has been raised by the exigencies of the war, and these two factors combined have caused the value of the colliery products this year to amount to $12,833,994, an increase over the preceding year of $4,349,651.

The increase in the selling-price of coal has been allowed at various times by the Dominion Government Fuel Controller, until, as nearly as can be calculated, the average price of coal for the year over the Province as a whole has been approximately $5 a ton, and the similar average price for coke about $7 a ton. What additional value this increased selling-price gave to this year's output of coal and coke may be realized by comparison with the average selling-prices assumed in former years of $3.50 a ton for coal and $6 a ton for coke. This additional value this year would amount to $3,642,334.

As regards the products of the metalliferous mines of the Province, as already noted, the combined values of these products shows an increase over the preceding year of $625,804, an increase which under the many adverse conditions prevailing is very encouraging.

The combined output of placer and lode gold shows an increase of $860,622—a rather pleasant surprise considering the greatly increased operating costs and the fact that the selling-price of gold remains stationary.

Of these products, the placer-gold production shows a decrease of $176,000, while lode gold shows an increase of $1,036,622, attributable to more active work in the Rossland camp and to a full year's output from the Surf Inlet mine—a new producer.

The value of the silver production this year was greater than that of the previous year by $950,121, due to the materially higher market value of the metal, as well as an increased production of 568,956 oz.

The value of the production of both lead and copper are each lower this year than in 1917, although the quantity of lead and of copper produced are both materially greater than in 1917, the increase in quantity of copper over the previous year's production being 2,476,189 lb., and that of lead being 6,592,196 lb. This is accounted for by a lower average market value of each metal during the year than that prevailing during 1917.

The figures for zinc production show that the 1918 output was only 75,597 lb. less than in the previous year, but owing to the lowered market price the value was $267,219 less than in 1917.

The value of the miscellaneous metals produced this past year was $97,311, while the value of the building materials of mineral origin amounted to $940,891, making a total for miscellaneous products of $1,038,202, which is $203,373 less than the 1917 output. The war conditions existing and the uncertainty as to the future caused an almost complete cessation of all building, with the exception of wooden structures.

As has been noted, the fluctuations of the market prices of the various metals and ores has been an uncertain factor during the war, and now that the war is over this uncertainty is very much greater. It is impossible to predict what demand there will be for the metals in the immediate future, and the transition stage between war conditions and peace conditions leaves the metal market in an entirely unsettled state.

Details of the market prices of metals will be found under the discussion of each metal, but it may be noted here that the rise in silver from an average of 50 cents an ounce in 1915 to an average of 97 cents in 1918 has proved very beneficial to the silver-lead mines of the Slocan.

The higher cost of labour and supplies—especially powder—has made the cost of new development very high, but in spite of this much work has been done.

Gold-mining also suffered from the increased costs of labour and supplies, with no corresponding increase in the value of the metal produced, thereby causing a smaller margin of profit, and, in many cases, making it unprofitable to mine gold.

For some time after the armistice was signed the market for copper, lead, and zinc practically disappeared. Nominal prices were maintained for a time, but inevitably, with no buyers, large accumulations of metals, and a steady though curtailed production, the market prices declined. By February (1919) copper had declined from the former maximum fixed price of 26 cents a pound to about 15 cents, and until the normal demand for this metal is resumed there is not likely to be either a material increase in the market price or a very heavy demand for it. Large stocks of copper were held by the Allied Governments at the time of the signing of the armistice, and until these are disposed of there will be but little demand for copper from European consumers.

The average market price for copper in 1918 was 24.63 cents, as compared with 27.18 cents in 1917.

The lead market is in a similar condition to the copper market, being dull and featureless. Since the armistice the nominal price has declined from about 8 cents to about 6 cents a pound. Large stocks of lead are reported in all the Allied countries, and it is apparent that it will be some time yet before the market demands will absorb these stocks.

Zinc is in much the same position as lead as regards market conditions. The nominal price declined from about 8.25 cents on November 12th to about 7.5 at the end of the year, and by February had dropped to about 6 cents.

Silver was the one metal which did not rise in price in the early stages of the war, as it was not directly used in war munitions or materials. In time, however, a serious shortage of silver occurred owing largely to the heavy demands for currency, occasioned by the rapid expansion of the world's monetary systems, and the almost complete withdrawal by the Governments of gold as a circulating medium of exchange. As might be expected with a steady and even abnormal demand for silver, the price rose, gradually at first and afterwards more quickly.

The average market price of silver in 1914 was 54.8 cents an ounce; in 1915, 49.7 cents; in 1916, 65.7 cents; in 1917, 81.4 cents; and in 1918 it was 96.77 cents.

The market outlook for silver is much better than for copper, lead, and zinc, and it seems reasonable to assume that the present price of about $1 an ounce may be maintained for some time.

At present the market for what are commonly called "war minerals" is practically non-existent, and quotations cannot be obtained, as the future demand for such materials is unknown.

During the year 1918 labour troubles in the mines and smelters were not numerous. The most serious one was in the Crowsnest District, owing to a disagreement over the "single-shift" system of operating the coal-mines, and the mines were closed for about a month.

In the fall of the year the epidemic of Spanish influenza caused a dislocation of the staffs and working forces generally throughout the mines and smelters of the Province, and in many places seriously curtailed production.

The prospects for the year 1919 are, when metal and mineral prices again become stabilized, that the mining industry in British Columbia should continue to prosper. The established producers are generally in good shape to continue production even at lowered metal prices, and when settled conditions arrive much new development should take place.

British Columbia has very large areas of undeveloped and unprospected mineral lands, and the return of peace will hasten the development of her mineral resources. There will be a

considerable accession to the ranks of the prospectors and more capital will be available for legitimate mining development.

The total gross amount of coal mined in the Province during the year was 2,578,724 tons (2,240 lb.), of which there was used for making coke some 276,479 tons, leaving a net production of coal, used as such, of 2,302,245 tons. The amount of coke produced was 188,967 tons (2,240 lb.). The increased selling-price of coal and coke has previously been discussed.

The value of the net coal production for the year was $11,511,225 and of coke $1,322,769, making the value of the production of the collieries $12,833,994.

The following table shows the number of mines which shipped ore during the year 1918, the districts in which they are situated, and the tonnage produced in each district, together with the number of men employed, both above ground and underground.

In explanation of the table it should be said that, in its preparation, a mine employing twelve men for four months is credited in the table with four men for twelve months, so that the total given is less than the actual number of individuals who worked in the mines during the year.

TABLE SHOWING DISTRIBUTION OF SHIPPING MINES IN 1918.

	Tons of Ore shipped.	No. of Mines shipping.	No. of Mines shipping over 100 Tons in 1918.	Men employed in these Mines.		
				Below.	Above.	Total.
CARIBOO DISTRICT:						
Omineca	6,956	5	3	35	40	75
CASSIAR DISTRICT:						
Atlin, Stikine	73	2	.....	4	6	10
Queen Charlotte, Portland Canal, Skeena, and Nass	956,231	10	5	350	174	524
EAST KOOTENAY DISTRICT:						
Fort Steele	137,950	4	3	162	139	301
Windermere-Golden	3,620	5	2	34	15	49
WEST KOOTENAY DISTRICT:						
Ainsworth	44,937	23	11	158	71	229
Slocan and Slocan City	142,700	40	16	403	240	643
Nelson and Arrow Lake	15,348	13	6	81	58	139
Trail Creek	112,349	5	5	250	82	332
Revelstoke, Lardeau, and Trout Lake	255	9	.....	21	14	35
BOUNDARY-YALE DISTRICT:						
Greenwood, Grand Forks, and Osoyoos	692,504	37	15	356	313	669
Similkameen, Nicola, and Vernon	73	3	.....	4	3	7
Yale, Ashcroft, and Kamloops	30,826	4	2	38	27	65
LILLOOET DISTRICT	3,858	5	3	13	17	30
SOUTHERN COAST DISTRICT	745,169	10	9	580	460	1,040
Total	2,892,849	175	80	2,489	1,659	4,148

In the following table of the non-shipping mines the returns are necessarily incomplete, as they include only the mines reporting to the Department, and not the prospects and properties under preliminary development, which in the aggregate give employment to a large number of men.

TABLE SHOWING NON-SHIPPING MINES AND MEN EMPLOYED.

DISTRICT.	NUMBER OF MINES.			MEN EMPLOYED.		
	Working.	Idle.	Total.	Below.	Above.	Total.
CARIBOO AND CASSIAR	9	9	18	18	23	41
EAST KOOTENAY	3	8	11	12	7	19
AINSWORTH	6	17	23	8	5	13
SLOCAN	13	16	29	42	16	58
NELSON	7	14	21	10	13	23
TRAIL CREEK	.....	8	8	.....	.....	.....
REVELSTOKE-LARDEAU	3	3	6	12	8	20
BOUNDARY-YALE	11	32	43	31	27	58
LILLOOET	1	3	4	2	.....	2
SOUTHERN COAST	3	12	15	2	6	8
Total	56	122	178	137	105	242

SUMMARY OF STATISTICAL TABLES.

Referring to the preceding tables of the mineral production of the Province, the following is a summary of their contents:—

TABLE I. shows the total gross value of each mineral product mined in the Province up to the end of 1918 aggregating $637,353,581. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of $187,147,652; followed next in importance by copper at $145,741,069, and next in order is lode gold at $97,121,786, with placer gold in fourth place at $75,436,103.

TABLE II. shows the value of the total production of the mines of the Province for each year from 1893 to 1918 (inclusive), during which period the output increased tenfold, and reached a gross production for the year 1918 of $41,782,474.

The value of the total mineral production of the Province up to the end of 1918 was $637,353,581.

TABLE III. gives the quantities in the customary units of measure, and the values, of the various metals or minerals which go to make up the total of the mineral production of the Province, and also, for the purpose of comparison, similar data for the two preceding years.

The table shows that there has been this year a decrease in the production of placer gold of $176,000, but an increase in the output of lode gold of $1,036,622, making a total increase of $860,622 in the total production of the metal.

The amount of silver produced this year was 3,498,172 oz., having a gross value of $3,215,870, an increase in the number of ounces of 568,956. The value of the silver production in 1918 was greater than in 1917, partly due to the prevailing high market price of silver in 1918.

The table shows an output of lead in 1918 amounting to 43,899,661 lb., valued at $2,928,107, which is an increase from the production of the preceding year of 6,592,196 lb. of lead, but a decrease in value of $22,913, due to the drop in price of the metal.

The production of copper this year was 61,483,754 lb., valued at $15,143,449, an increase in amount of 2,476,189 lb., or about 4.2 per cent. The value of the product was less than that of the preceding year by $894,807—a decrease of nearly 8 per cent., due to lower prices.

TABLE IV. shows the proportions of the total mineral productions made in each of the various districts into which the Province is divided.

It will be noted that this year the Southern Coast District has again the honour of first place on the list, followed, in order of importance, by the Cassiar, East Kootenay, West Kootenay, and Boundary Districts. The Southern Coast and East Kootenay Districts owe a considerable proportion of their output to the coal-mines situated within their limits, whereas, in the other districts, the production is chiefly from metal-mining.

The Southern Coast District also derives a fair proportion of its production from "Miscellaneous products," such as building materials, etc., due to the larger cities therein; this year this amounted to $750,305, as shown in Table V.

TABLE V. is a table introduced seven years ago, and is an endeavour to show in some detail the production of those products, such as building materials, previously summarized under "Miscellaneous products," and which amounts this year to $1,038,202. Much difficulty has been found in obtaining reliable figures regarding these products, and in many cases they have had to be estimated; but, while the figures are not as complete as desired, they are at least approximate, and show what an important branch of mineral production this has become, despite the falling-off due to the war and depressed financial conditions.

TABLE VI. shows the statistical record of the placer mines of the Province from 1858 to 1918, and shows a total production of $75,436,103. The output for 1918 was $320,000, a decrease, as compared with the previous year, of 35.5 per cent.

TABLE VII. relates entirely to the lode mines of the Province, and shows the quantities and values of the various metals produced each year since the beginning, in 1887, of such mining in the Province. The gross value of the product of these mines to date is $345,274,795, this figure includes the zinc production of 1909 and all subsequent years.

Lately a new column was made in this table in which to record the zinc production, and the output since 1909 has been recorded therein. In former years the zinc production was small and was listed as miscellaneous material.

TABLE VIII. contains the statistics of production of the coal-mines of the Province. The total amount of coal produced to the end of 1918 was 49,346,829 tons (of 2,240 lb.), worth $164,476,478. Of this, there was produced in 1918 2,302,245 tons valued at $11,511,225, an increase of 152,270 tons in quantity and of $3,986,312 in value compared with the preceding year. In these figures of coal production the coal used in making coke is not included, as such coal is accounted for in the figures of output of coke. The amount of coal used in making coke in 1918 was 276,479 tons, from which was made 188,967 tons of coke, having a value of $1,322,769, an increase in amount over the preceding year of 29,062 tons, or about 18.1 per cent., with an increase in value of $363,339. The total value of the output of the collieries of the Province in 1918 was $12,833,994.

The average selling-prices taken this year in the calculation of value of product are much higher than those used last year. Increases in the selling-price of coal have been allowed at various times by the Dominion Government Fuel Controller, until, as nearly as can be calculated, the average price of coal for the year over the Province as a whole has been approximately $5 a ton, and the similar average price for coke about $7 a ton. What additional value this increased selling-price gave to this year's output of coal and coke may be realized by comparison with the average selling-prices assumed in former years of $3.50 a ton for coal and $6 a ton for coke. This additional value this year would amount to about $3,650,000. The prices used in calculations prior to 1907 were $3 and $5 respectively.

More detailed statistics as to the coal production of the Province and of the separate districts are given elsewhere in this Report.

TABLE IX. gives the details of production of metalliferous mines of the Province for the years 1915, 1916, 1917, and 1918, and the districts in which such productions were made, showing the tonnage of ore mined in each district, with its metallic contents and its market value.

The total tonnage of ore mined in the Province during the year 1918 was 2,892,849 tons, having a gross value of $27,590,278, and, with the placer gold, a total value of $27,910,278.

The following table shows the tonnage derived from the various districts of the Province:—

	Tons.
Cassiar and Omineca District	963,260
Southern Coast District	745,169
Boundary-Yale District	723,403
Slocan Mining Division	142,700
East Kootenay District	141,570
Trail Creek Mining Division	112,349
Ainsworth Mining Division	44,937
Nelson Mining Division	15,348
Other Mining Divisions	4,113
Total	2,892,849

In reports previous to 1910 there has been included in Table IX. the "Miscellaneous products," and in 1910 these were shown distributed to the various districts; the great increase of these products in the past few years has rendered it advisable that this table be reserved exclusively for metalliferous products, and so a new table (No. V.) was introduced in 1911, giving in some detail the output of these miscellaneous products.

In making comparisons of this table with similar tables in previous reports, the fact that "Miscellaneous" has been removed will have to be borne in mind.

TABLE X. presents in graphic form the facts shown in figures in the tables, and demonstrates to the eye the rapid growth of lode-mining in the Province, and also the fluctuations to which it has been subject.

It will be seen that, although coal-mining has been a constantly increasing industry during this whole period of twenty-six years, lode-mining did not begin, practically, until 1894, since when it has risen with remarkable rapidity, though not without interruption, until it reached, in 1906, the $17,500,000 line. The total mineral production in 1910 reached the $26,000,000 line, in 1912 it reached the $32,000,000 line, in 1916 the $42,000,000 line, while this year it is just a little below that line.

GOLD.

Placer Gold.

The production of placer gold during the past year was worth about $320,000 as nearly as can be ascertained; great difficulty is found in obtaining reliable figures, since the work is, in many cases, carried out by individuals or unorganized groups of men who keep no books, frequently paying wages, or for supplies, in gold-dust, which, being readily transported, is scattered, and the tax imposed thereon by law is thus evaded. This year's output shows a decrease, as compared with 1916, of $84,500.

The production of placer gold is nearly all from the Atlin and Cariboo Districts, about 96 per cent. of the total coming from these two sections.

In hydraulic placer-mining, from which about 90 per cent. of the placer gold obtained in British Columbia is derived, it has been pretty well demonstrated that the gold-output is in direct proportion to the number of days in which water was available for piping.

In the Atlin Division water conditions were normal, so far as is known, but the shortage of labour handicapped operations. So many men have left the district for active service in the war that not only were the larger companies short of labour, but also the number of individuals mining in a small way was materially less than in former years.

In the Cariboo District water conditions were not good owing to the snowfall of the previous winter, which melted off suddenly, and this was followed by a dry summer. The output for the Cariboo and Quesnel Divisions was less than in 1917.

Gold-mining in all forms has suffered by the war, due to the fact that the cost of labour and supplies has materially increased, while the price of the product remains standard; hence operating costs are higher and profits lower.

Due to the greatly enhanced market price of the base metals, such mines operating on a sliding scale of wages, regulated by the prices of metals, have been paying abnormally high wages, which has drawn miners away from gold-mining, both placer and lode.

In addition to the increased cost of all supplies, etc., the war conditions have also rendered it almost impossible to obtain new equipment at any price. There has therefore been less inducement for capital to enter into new placer-mining enterprises, either hydraulic or dredging. The development of new placer enterprises in the Cariboo and Atlin fields and elsewhere in the Province can therefore hardly be expected until conditions again become normal.

Complete news has not been received from the Omineca District, where considerable work has been going on, most of which, however, was of a preparatory nature, and it is not expected that any great output was made this year, probably not more than about $8,000 all told.

In the Liard-Stikine District the Boulder Creek Hydraulic Mining Company did not work on Thibert creek. Ball and Finn and Mitchell Bros., working in the same vicinity, made small outputs.

Different partnerships were at work on Dease creek, with success enough to at least pay wages.

This year a little gold was taken out of the Tahltan river by Indians and others working in the river-bed.

As was noted last year, two or three parties were working down the Liard river, at McDame creek, and on Rosella creek, a section that has been practically abandoned of late years.

Considerable work in connection with placer-mining was done in the Similkameen District, although the actual production was small.

Vernon District also yielded some gold from hydraulic operations in Siwash creek.

Yale Mining Division made an unusually small output, and the Fort Steele Mining Division made a smaller output than last year.

Gold from Lode-mining.

The value of the gold produced from lode-mining in the Province during the year 1918 was $3,403,812, an increase, as compared with the previous year, of $1,036,622, or about 43.7 per cent. It must be remembered, however, that the 1917 gold production was abnormally low, the output for the years preceding the war varying from $4,000,000 to $5,000,000. The increase in 1918 over the preceding year is largely due to the entry into the producers' list of a new mine—the Surf Inlet property of the Belmont-Surf Inlet Mines—which made an output of about 41,600 oz. But for this added production the gold-output for 1918 would have been practically the same as in 1917.

The Rossland mines, which prior to 1917 contributed annually about one-half of the output of lode-gold, made about the same production in 1918 as in the preceding year; during these two years about one-quarter the normal output was made. The mines were worked somewhat irregularly during the first six months of the year; after that development was continued and shipments were renewed, resulting in an increased tonnage as compared with 1917.

The following table shows the gold productions of 1917 and 1918:—

	1917. Oz.	1918. Oz.
Boundary-Yale	60,010	55,353
Rossland	33,290	43,745
Skeena	9,805	48,016
Coast (Southern)	3,793	5,565
Lillooet	3,092	2,473
Nelson	2,521	7,155
All others	2,012	2,367
Totals	114,523	164,674

From the above table it will be seen that there are increases in Skeena, Rossland, Coast (Southern), and Nelson Districts, while there are decreases in the gold production from Boundary-Yale and Lillooet Districts.

The increase in the Nelson Division is due to a larger tonnage from the *Yankee Girl* mine, near Ymir. The production from the *Nickel Plate* mine, at Hedley, about 35,000 oz., was practically the same as in the previous year. The small decrease in the Boundary-Yale District as compared with 1917 is due to a smaller tonnage of copper ore carrying low gold values being treated at the Granby smelter.

SILVER.

The total amount of silver produced in the Province during the year 1918 was 3,498,172 oz., valued at $3,215,870, an increase in amount, as compared with the previous year, of 568,956 oz., and an increase in value of $950,121, partly due to the high price of the metal.

The market price of silver gradually rose during the year, the average for January being 88.702 cents an ounce, while in December it was about 101.125 cents. The average for the year was 96.77 cents, the highest that silver has been for many years back. The prospect of silver maintaining its present price of about $1 an ounce is good, and in this respect the silver market is in marked contrast to the other metals, the future prices of which are uncertain.

The silver production of the various districts for the year has been as follows:—

	Oz.
Slocan and Slocan City	1,873,236
Skeena	416,616
Fort Steele	261,497
Ainsworth	228,699
Boundary-Yale	228,561
Nelson	136,738
Southern Coast	116,425
Windermere-Golden	91,784
Omineca	84,125
Trail Creek	47,203
All others	13,288
Total	3,498,172

As will be noted from the above table, the Slocan District again leads all others in the production of silver, having produced 47 per cent. of the total output. As compared with 1917, the production from this district was greater in 1918 by 325,660 oz.

The largest producer in the Slocan was the *Surprise*, followed by the *Queen Bess* and the *Standard*. There were nearly 40 shipping mines in the district in 1918.

The figures for the year show small increases in output from Skeena, Ainsworth, Boundary-Yale, Fort Steele, Coast, Omineca, and Windermere-Golden Districts.

About 50 per cent. of the silver-output from the Boundary District comes from the Granby Company's mines at Phoenix. Other mines contributing are the *Mother Lode*, *Sally*, and *Union*.

The silver production from Trail Creek comes from the smelting of the gold-copper ores of Rossland camp, which carry about ½ oz. of silver to the ton.

The Skeena production comes almost entirely from the Granby Company's *Hidden Creek* mines, at Anyox.

The Coast production of silver comes from the smelting of copper ores carrying low values in the precious metals. As a larger tonnage of copper ore was smelted, the silver-output shows an increase.

About 75 per cent. of the total Provincial output of silver comes from the treatment of silver-lead-zinc ores and the balance mainly from the smelting of gold-copper ores carrying silver.

LEAD.

The total amount of lead produced in 1918 was 43,899,661 lb., valued at $2,928,107. This represents, as compared with the previous year, an increase in quantity of 6,592,196 lb., but owing to the lower market price of lead a decrease in value of $22,913.

The market price of lead rose and fell during the year; the average for January was 6.782 cents a pound; in July a fixed price of 8.05 cents was established, which was held until the armistice was signed. Since then the lead market has been very dull; the producers hold large stocks and very few sales are being made. The nominal price declined to somewhere about 6 cents at the end of the year. The average price for the year was 7.413 cents a pound.

The following table shows the production of lead according to districts:—

	Lb.
Fort Steele	18,695,565
Slocan	14,575,379
Ainsworth	6,106,262
Windermere-Golden	2,659,210
Nelson	1,611,166
All others	252,079
Total	43,899,661

The above figures show, as compared with the previous year, that the lead production in 1918 was increased in Fort Steele, Slocan, and Windermere-Golden Districts, and decreased in the Ainsworth and Nelson outputs.

Fort Steele Division again leads all other districts. The *Sullivan* mine contributes nearly all of this production as a rule, but this year over 860,000 lb. came from the *North Star*.

In the Slocan District the heaviest producer in 1918 was the *Queen Bess*, followed by the *Surprise*, *Van-Roi*, *Galena Farm*, and *Standard*.

In the Ainsworth Division the largest producer was the *Florence*, with an output of about 2,500,000 lb., followed by the *Blue Bell*, with approximately 1,300,000 lb.; the *Highland* and *Cork-Province*, each with over 600,000 lb.; and about fifteen smaller shippers.

The lead production of Nelson Division comes almost entirely from the *Emerald* mine, and this mine produced about the same as in the previous year.

The production from Windermere-Golden is nearly twice that of the previous year, due to an increased output from the *Paradise* mine and a production of about 800,000 lb. from the *Couverapee* mine, at Field.

COPPER.

The amount of copper produced in 1918 shows, as compared with the previous year, an increase in quantity, but, owing to the lower market selling-price, a decrease in value. The production was 61,483,754 lb., which is 2,476,189 lb. greater than the 1917 output; the value for this year is $15,143,449, which, compared with $16,038,256 made in 1917, shows a decrease of $894,807. It is most encouraging, however, that, notwithstanding lowered market prices, the Provincial production of copper shows an increase in the quantity of metal produced of about 4.2 per cent. over the previous year.

During the whole of 1918 the price of copper in the United States was controlled by the maximum price fixed by the United States War Industries Board. From January to July the fixed price was 23.5 cents a pound, and from July until the end of the year it was 26 cents, the average for the year being 24.63 cents.

The following table shows the production of copper according to districts:—

	Lb.
Skeena Division	30,190,606
Southern Coast District	18,475,013
Boundary-Yale District	9,940,125
Trail Creek Division	1,654,356
Omineca Division	643,843
All others	579,811
Total	61,483,754

The *Hidden Creek* mines and the smelter at Anyox of the Granby Consolidated Mining and Smelting Company were operated practically continuously throughout the year, although closed for a short time by a strike, which was soon settled. A larger tonnage was treated than in 1917, amounting to approximately 858,000 tons, together with quartz and limestone flux to the extent of some 73,000 tons. With the increased tonnage handled there was a corresponding increase in the output of copper, 29,692,376 lb. being produced, as compared with 27,661,301 lb. in 1917.

In the Boundary District the Granby Company's mines at Phoenix were unable to supply the smelter at Grand Forks with sufficient ore to run the smelter at capacity. The ore reserves of these mines are approaching exhaustion, so that the large-scale production of former years cannot be maintained. Also the high operating costs during 1918 left but little margin of profit in working the low-grade ores at Phoenix. Or, to quote the Granby Company's anual report: "The old Phoenix mine has been run more from patriotism than hope of profits." The tonnage mined and smelted was approximately 444,000 tons, containing 7,347,273 lb. copper (recovered content), which is an increase of 488,555 lb. over the production figures of 1917; the 1917 output was only about one-half that of former years.

The Canada Copper Corporation, operating the *Mother Lode* mine and smelter at Greenwood, treated a slightly smaller tonnage than in 1917. About 154,000 tons was handled, from which 1,832,382 lb. of copper was recovered, together with low gold and silver contents. Towards the end of the year the smelter was closed, the ore reserves at the *Mother Lode* mine being exhausted.

The *Britannia* mine had a very successful year, approximately 731,000 tons of ore being milled, the production of copper from which was 17,548,127 lb. This is nearly 1,767,297 lb. greater than the 1917 production.

The *Marble Bay* mine, on Texada island, made about the same production as in 1917, the output being 626,442 lb.

Half a dozen smaller shippers are listed from the Southern Coast District, but the total copper from this source only amounts to 300,000 lb.

The Omineca Division produced less copper than in 1917, the output being 643,843 lb.

Copper-mining is now firmly established as the most important form of mining in the Province, and from all indications it should maintain this place for years to come. In 1918 the value of the copper mined exceeded by over $2,000,000 the combined values of all other metals mined, and it formed 55 per cent. of the total value of the metallic mineral production for the year.

It is also to be noted that about 80 per cent. of the copper-output is produced on the Coast, which has become the centre of the copper-mining industry, thus replacing the Boundary District, the old centre.

On Vancouver island the amount of copper produced has been very small comparatively, but there are under development at present at Jordan river and near Quatsino sound two properties on which active development has been carried on with such success as to indicate a large production within a few years.

ZINC.

The quantity of zinc produced in 1918 amounted to 41,772,916 lb., compared with 41,848,513 lb. produced in 1917. This production is valued at $2,899,040, which shows a still further proportionate decrease as compared with the 1917 value, due to the decreased market price of the metal.

The price of zinc on the New York metal market did not fluctuate greatly during the year. The average price for January was 7.836 cents a pound, and in November 8.491 cents. Since the armistice the market has been inactive, with practically no sales, so that quotations have been nominal. At the end of the year the price had declined to about 7.5 cents a pound, while the average price for the year was 8.159 cents.

The following table shows the production of zinc according to districts:—

	Lb.
Fort Steele	26,704,806
Slocan	14,107,682
Omineca	313,112
Ainsworth	640,991
All others	6,325
Total	41,772,916

These figures show, as compared with 1917, an increase in the Fort Steele production of nearly 6,000,000 lb., and a decrease of about 4,500,000 lb. in the Slocan output.

The Fort Steele production comes entirely from the *Sullivan* mine. The ore is treated in the electrolytic zinc plant at Trail.

In the Slocan District the heaviest shipper was again the *Standard*, with a production of over 7,000,000 lb., which, however, is 3,000,000 lb. less than in 1917. The next largest shipper was the *Surprise*, followed by the *Lucky Jim* and the *Galena Farm*.

The production of Ainsworth is only about two-thirds of last year's production.

The Omineca production is mainly a silver-zinc concentrate from the *Silver Standard* mine at Hazelton.

OTHER MINERALS.

The demands made by the recent great war caused a great and insistent demand for many of the minerals little known to the public, while the conditions brought about by the war, in shutting off former sources of supply, with a general interruption of the world's markets and transportation channels, forced upwards the market values of many minerals, which under these conditions could be and were worked to a profit where formerly they were commercially unworkable.

Since peace may be said to be again established, this urgent demand has ceased, and until experience has shown what the demands of the new conditions will prove to be, the markets and the market prices are so disrupted that very few sales are taking place.

Iron Ore.

The past year has seen a very great demand for iron and steel on the Pacific Coast, the normal demand having been greatly increased by the need for steel in ship-building and munitions work, while the usual outside sources have been monopolized by war needs in other parts of the world and the high freight rates have made the lack of local production more pronounced. Consequently, it has been strongly advocated in many quarters that the conditions are favourable for the establishment of an iron-smelting plant somewhere on the British Columbia coast. So far nothing definite has materialized, although there is apparently a prospect of such a plant being established on this Coast. As is well known, there is on the Coast, in the aggregate, an adequate supply of magnetite-iron ore, quite sufficiently free from impurities as to be within the "Bessemer limit," to supply ore for such a plant.

The magnetite-deposits of the Coast have therefore had some attention bestowed on them during the past year; this, however, was mainly confined to examination, with but little development. Bulletin No. 3, 1917, of this Department describes the more important magnetite-deposits of the Coast.

A few hundred tons of bog-iron ore was shipped from a deposit near Mons, on the Pacific Great Eastern Railway, to Irondale, Wash., where it was smelted in conjunction with mill cinder and scrap. This ore ran from 40 to 50 per cent. of iron, but was above the Bessemer limit in phosphorus.

Some magnetite ore was also shipped from Texada island to the Irondale furnace.

During the summer months the Provincial Government engaged Dr. Alfred Stansfield, of Montreal, to make a report on the commercial feasibility of smelting British Columbia magnetites in an electric furnace; the abnormal price of iron due to war conditions offering a seeming field for that class of smelting. Dr. Stansfield's report has been published as Bulletin No. 2, 1919.

Platinum.

The very insistent demand for platinum for war purposes caused a most exhaustive search to be made for it in commercial quantities by the Dominion Government officials: the well-known fact of its wide distribution throughout the Province in connection with our placer-gold deposits giving reasonable hope for such investigations. In connection with this search a number of drill-holes were sunk in the Similkameen District, the final results of which are not yet available.

A small amount of crude platinum was saved as a by-product from placer-gold workings, the exact quantities not being known.

Arsenic.

A production of arsenic valued at $20,000 was made by the *Nickel Plate* mine in 1917, and in 1918 about $40,000 worth was recovered from the arsenical iron pyrites forming the mill concentrates, thus forming a by-product to the gold-mining operations of the company. These concentrates have been going to the smelter for years, but until the recent installation of an arsenic-burner the arsenic content was not recovered.

Molybdenite.—The urgent demand for molybdenite for war purposes continued throughout the first half of the year, but gradually the market fell away. Since the armistice the market is dormant, like other metal prices, but nominal quotations vary from 75 cents to $1 a pound.

During the year a car-load of molybdenite ore, carrying also gold, cobalt, and arsenic, was shipped from the *Hazelton View* mine, Hazelton, to the Ottawa Mines Department for treatment; the gross returns from this car were about $2,400. A small shipment of molybdenite was made from the *Golconda* claim, Osoyoos Mining Division. No other molybdenite shipments have been reported.

Chromite.—About 800 tons of chromite ore, carrying from 30 to 45 per cent. chromic oxide, was shipped from the *Mastodon* claim, Grand Forks Division; and a deposit on Scottie creek, near Clinton, was opened up, but no shipments made.

With the end of the war the market for chromite has temporarily collapsed, as large stocks are available, with no purchasers in sight.

Manganese.—Fifteen car-loads of ore, containing from 35 to 50 per cent. manganese, was shipped from the Curle *Manganese* group, near Kaslo.

A large deposit of high-grade manganese ore was discovered during the summer near Cowichan lake. No shipments were made.

Non-metallic Minerals.—One hundred tons of fluorspar was shipped from the *Rock Candy* group, in the Grand Forks Division. This property is now owned by the Consolidated Mining and Smelting Company and is being equipped to make steady shipments in the future. The

mineral is shipped to the Trail smelter and is used for making hydrofluoric acid, which is used in the lead-refinery.

Shipments of magnesium sulphate (Epsom salt) were made from Spotted lake, Osoyoos Division, but figures have not been obtained. One hundred and seventy tons of magnesium sulphate was shipped from deposits of this material near Clinton.

Deposits of hydromagnesite in the Clinton Division, which are reported to be large and of great purity, have attracted considerable attention during the past year. No shipments have been recorded.

The production of miscellaneous minerals in British Columbia in 1918 was valued at $97,311.

COAL.

The gross production of coal in 1918 was 2,578,724 long tons, of which 276,479 tons was made into coke, leaving the net production at 2,302,245 tons. These figures show an increase, as compared with 1917, of 180,009 tons gross and of 152,270 tons net. The quantity of coke made was 188,967 tons, which is an increase of 29,062 tons as compared with 1917. For purposes of comparison the following table is shown:—

	1913.	1914.	1915.	1916.	1917.	1918.
Coal, gross.....tons, 2,240 lb..	2,570,760	2,166,428	1,972,580	2,485,580	2,398,715	2,578,724
Less made into coke "	433,277	355,461	361,451	401,487	248,740	276,479
Coal, net..... "	2,137,483	1,810,967	1,611,129	2,084,093	2,149,975	2,302,245
Coke made..... "	286,045	234,577	245,871	267,725	159,905	188,967

Summarizing the Provincial production of coal, the following table shows the output:—

	1915.	1916.	1917.	1918.
Vancouver Island mines.....tons, 2,240 lb.	1,020,942	1,492,761	1,695,721	1,666,211
Nicola and Similkameen mines..... "	99,066	110,549	151,243	179,179
Crowsnest mines..... "	852,572	882,270	551,751	732,864
Omineca-Telkwa ..... "	.....	.....	.....	470
Total quantity of coal mined..... "	1,972,580	2,485,580	2,398,715	2,578,724
Less made into coke..... "	361,451	401,487	248,740	276,479
Net quantity of coal produced ..... "	1,611,129	2,084,093	2,149,975	2,302,245

In addition to the above net production of coal, there was made the coke production shown in the following table:—

	1915.	1916.	1917.	1918.
Vancouver Island collieries.....tons, 2,240 lb.	5,450	27,604	30,406	24,887
Nicola and Similkameen collieries... "	*Nil*	*Nil*	*Nil*	*Nil*
Crowsnest District collieries..... "	240,421	240,121	129,499	164,080
Total coke production..... "	245,871	267,725	159,905	188,967

As will be seen from the above figures, the net coal production this year is 152,270 tons more than it was in 1917, and greater than it has been since 1912.

This output would have been considerably greater had not there been during the year a serious shortage of labour—partly caused by the heavy enlistment of the younger men—and in the early part of the year there were labour troubles that interfered with production. All these contributed to occasion a shortage of both coal and coke when the demand was most keen.

The production of coke in 1918 was 188,967 tons (2,240 lb.), which is 29,062 tons greater than the preceding year. Of this gross coke production, 164,080 tons was made by the Crow's Nest Pass Coal Company in East Kootenay, and the remaining 24,887 tons was made by the Canadian Collieries at Comox, V.I.

The greater part of the gross Provincial production is still being mined by three companies—the Crow's Nest Pass Coal Company of East Kootenay, the Canadian Collieries, and the Western Fuel Company of Vancouver island, which mined, collectively, 82.7 per cent. of the gross output, their respective production representing 23.6 per cent., 30.7 per cent., and 28.4 per cent. of such total.

Of the other collieries: In the Coast District, on Vancouver island, the Pacific Coast Coal Mines, Limited, produced 82,629 tons; the British Columbia Coal Mining Company 14,068 tons; the Nanoose Collieries, Limited, 28,804 tons; and the Granby Company, from a new colliery near Cassidy, produced 16,958 tons. In the Nicola Valley section of the district, the Middlesboro Colliery Company mined 101,559 tons; the Fleming Coal Company 33,203 tons; the Princeton Coal and Land Company 38,673 tons; and the Coalmont Colliery some 5,744 tons of coal.

A new coalfield has been opened up in the Omineca District, where a small colliery is being developed on the Telkwa river that last year shipped 470 tons of coal. For convenience this has been included in the Coast District figures.

In the East Kootenay District, in addition to the Crow's Nest Pass Coal Company, which produced 608,875 tons, the Corbin Coal and Coke Company produced 123,989 tons.

In addition to those companies actually shipping, several other companies have been installing plant and have approached the shipping stage, mention of which will be made elsewhere in this Report.

The collieries of the Coast District, including the Nicola-Princeton fields, are to be credited this year with about 71.5 per cent. of the total coal-output.

The gross output of the collieries of the Province for the past year was, as already stated 2,578,724 tons, of which 40,902 tons of coal was added to stock.

Of this gross amount, there was sold for consumption in Canada, 1,010,938 tons; sold for consumption in the United States, 752,821 tons; sold in other countries, 58,417 tons; making the total coal sales for the year 1,822,176 tons of 2,240 lb.

In addition to the coal sold, there was used in the manufacture of coke 276,479 tons, and used under companies' boilers, etc., 200,698 tons; while 238,469 tons was lost in washing and screening.

The coke sales of the Province for the past year amounted to 189,680 tons, of which 828 tons was taken from stock.

The following table indicates the markets in which the coal and coke output of the Province was sold:—

COAL.	Coast District.	Crowsnest Pass District.	Total for Province.
Sold for consumption in Canada ..... tons, 2,240 lb.	933,296	77,642	1,010,938
" export to United States ..... "	410,603	342,218	752,821
" export to other countries ..... "	58,417	.....	58,417
Total coal sales	1,402,316	419,860	1,822,176
COKE.			
Sold for consumption in Canada ..... tons, 2,240 lb.	24,510	147,725	172,276
" export to United States ..... "	.....	17,404	17,404
" export to other countries ..... "	.....	.....	.....
Total coke sales	24,510	165,179	189,680

COLLIERIES OF COAST DISTRICT.

The Collieries of the Coast District, which includes those on Vancouver island and in the Nicola-Princeton fields, and a small colliery in Telkwa District, mined 1,845,860 tons of coal in 1918, of which 22,845 tons was added to stock, making 1,823,015 tons distributed from these collieries in 1918. This amount was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada	933,296	
Sold as coal in United States	410,603	
Sold as coal in other countries	58,417	
Total sold as coal		1,402,316
Used under companies' boilers, etc.		142,058
Used in making coke		40,172
Lost in washing, etc.		238,469
		1,823,015
Plus coal added to stock		22,845
Gross output		1,845,860

The total coal sales of the Coast collieries for the year show, as compared with the sales of the previous year, a decrease of 26,288 tons, equivalent to over 1.9 per cent.

The coal sold in Canada by the collieries of the Coast District this year shows an increase of 71,624 tons, or about 8.3 per cent. from the preceding year; the amount exported to the United States was 118,118 tons less, and 58,417 tons of coal was exported to other countries.

Only one company in the Coast District—the Canadian Collieries, Limited—has ever made coke; in 1916 the ovens were again put in operation after several years of inactivity, and in 1918 this company produced 24,887 tons (2,240 lb.) of coke, 115 tons was burned under the company's boilers, of which 271 tons was added to stock, making the total sales for the year 24,501 tons.

On Vancouver island six companies produced coal this year—the Canadian Collieries, Limited, the Western Fuel Company, the Pacific Coast Coal Mines, the British Columbia Coal Mining Company, the Nanoose Collieries, Limited, and the Granby Colliery; the majority of these companies each operate two, or more, collieries. The combined gross output of the Island collieries was 1,666,211 tons.

In the Nicola and Princeton coalfields of the Coast District, the Middlesboro Colliery Company produced 101,559 tons of coal; the Princeton Colliery, 38,673 tons; the Fleming Coal Company, 33,203 tons; and the Coalmont Collieries, 5,744 tons.

The total output of this portion of the sub-district was 179,179 tons.

EAST KOOTENAY COALFIELD.

There were only two companies operating in this district this past year—the Crow's Nest Pass Coal Company, operating two separate collieries, the combined output of which was 608,875 tons; and the Corbin Coal and Coke Company, which made an output of 123,989 tons; making a gross output for the district for 1918 of 732,864 tons of coal.

Of the coal mined, 18,057 tons was added to stock, making the amount of coal distributed from the collieries 714,807 tons.

Of this gross tonnage, 236,307 tons was used in the manufacture of coke, of which there was produced 164,080 tons (2,240 lb.).

The coke sold this year amounted to 165,179 tons, of which 1,099 tons was taken from stock.

The following table shows the distribution made of the coal of this district:—

	Tons.	Tons.
Sold as coal in Canada	77,642	
Sold as coal in United States	342,218	
Total sold as coal		419,860
Used by the companies in making coke		236,307
Used by the companies under boilers, etc.		58,640
		714,807
Plus coal added to stock		18,057
Gross output		732,864

BUILDING MATERIALS.

The production of building materials in 1918 was less than in the preceding year, being $940,891 as compared with $1,204,546. The statistical returns are not yet as complete as could be desired, due to the reluctance of a few producers to give returns, but it is believed the figure given above approximates very closely to the actual output. Since 1912, when a production, amounting to $3,435,722 was recorded, the output of building materials has steadily declined, due to the cessation of the building trade, brought about by the continued financial depression, and the war. It is probable that the figures have now reached a minimum, and that an output amounting from $1,000,000 to $1,500,000 represents the steady yearly demand for these materials for use in repairs, renewals, and various small demands, without any new construction-work. It may be expected, therefore, that the production will remain at about this figure until a period of active construction-work again commences in the Province. The diminution of production has been general in all kinds of material.

The outputs of sand and gravel, of brick, pottery, and cement are all slightly less than in 1917, but the decrease is not serious. The output of fire and face bricks shows an increase, due to a slightly larger production by the Clayburn Company. Approximately 80 per cent. of the total production of building materials comes from the Coast District, and the larger part of this finds its markets in the Coast cities.

In Table V., where the production of building materials is given in detail by districts, the column previously headed "Clay, Gypsum, etc.," was changed in 1916 to "Miscellaneous Minerals," this column being used for listing the production of hydromagnesite from Atlin, molybdenite from Skeena, Lillooet, Nelson, arsenic from Osoyoos, and antimony ore from Slocan. The column previously headed "Crushed Rock" is now "Crushed Rock and Flux"; in it is recorded, in addition to the crushed rock, the value of limestone and quartz which are quarried for use at the smelters as flux.

Building-stone. Excellent building-stone of various sorts is found in abundance in almost every part of the Province; the fact of its widespread distribution has, however, been somewhat against the establishment of large quarrying industries, as a sufficient local supply could always be obtained, and, except within reach of the larger cities, few regularly equipped quarries have been opened.

On the Coast, chiefly between Vancouver island and the Mainland, there are several well-equipped quarries taking out granite, sandstone, and andesite, all of excellent quality. These quarries supply the stone building material of the Coast cities, and have also exported to the United States.

A detailed description of the more important quarries was given in the Report of this Bureau for 1904.

Red Brick. The production of red brick during the past year was about 3,600 M.; the price varies from $10 to $12 a thousand, according to quality and demand. This small output shows very clearly that but little construction-work has been carried on. It is probable, however, that a considerable quantity of brick is still imported into the Province.

Firebrick. The only company producing firebrick in the Province is the Clayburn Company, Limited, with a plant at Clayburn. The fireclay is found here as a bed occurring in bedded rocks of Eocene age. Shales, sandstones, and conglomerates, all but little consolidated, make up this sedimentary series. The shales are quarried or mined for brick-making and one bed is an excellent fireclay. Associated with these rocks is a bed of lignite which is sufficiently good to be used for firing the boilers of the plant. The production of this company was a little greater than in 1917. Firebrick is the principal manufactured article produced by this company, but, in addition, considerable quantities of common brick, paving-brick, tiles, drain-pipe, and prepared fireclay are made. The output for the year is valued at over $250,000.

Pottery Drain-pipe and Tile. The British Columbia Pottery Company at Victoria West, which manufactures drain and sewer pipes, chimney-tiles, etc., made a smaller production in 1918 than in the previous year. The Port Haney Brick Company, besides manufacturing common brick, also makes drain-pipe, partition-blocks, etc.

Lime. The manufacture of lime is conducted in a small way at a large number of points in the Province, but only on the Coast has any attempt been made at more extensive operations. In the neighbourhood of Victoria, on Esquimalt harbour, three kilns are in operation, and there are kilns on Saanich arm. On Texada island—in addition to the old plant at Marble bay—a new and extensive plant was erected at Blubber bay a few years ago. The limestone being used is of exceptional purity, but in some instances the limestone-beds are cut by igneous dykes which have to be rejected, and this somewhat increases the cost of quarrying.

The production of lime and limestone for 1918 is valued at $28,536, as compared with $102,223 in 1917, and in addition nearly $100,000 worth of limestone was quarried for use as smelter flux by the Granby and Consolidated Companies.

Portland Cement. There are two large and well-equipped cement plants in the Province, both situated on Saanich inlet. The Vancouver Portland Cement Company, of Tod inlet (R. P. Butchart, president, Board of Trade Building, Victoria), made an output of Portland cement, of a value of nearly $300,000. This company also manufactured for the Associated Cement Company, whose works at Bamberton were not operated this past year.

Crushed Rock and Gravel. The returns for crushed rock and gravel indicate a falling-off in the demand for this material. Some of the plants which have been in operation for the past two or three years ceased operations, and others made a smaller output than in the previous year.

During the boom years of 1911 and 1912 a number of well-equipped plants were put up near Vancouver and Victoria for supplying washed sand and gravel, properly screened to size. Some of these companies use a system of mining the gravel by hydraulic streams and carrying the product to the screens by the water used. Practically all of these plants are now idle, as there is but little demand for sand and gravel.

BUREAU OF MINES.

WORK OF THE YEAR.

The work of the Bureau of Mines naturally increases year by year, this growing activity being due to the following causes: The extension of the mining area of the Province, with the proportional increase in the number of mines; the increasing desire of the outside public for the free information which the Bureau supplies with regard to the various mining districts and camps, and the appreciation by the prospector of the fact that he may obtain, gratis, a determination of any rock or mineral which he may send to the Bureau.

The routine work of the office, and the preparation and publication of the Report for the year just ended, followed by the examination in the field of as many of the mines and mining districts as the season would permit, together with the work of the Laboratory, fully occupied the staff for the year.

The permanent staff of the Bureau now consists of the Provincial Mineralogist and Assayer, Wm. Fleet Robertson; the Assistant Provincial Assayer and Provincial Analyst, D. E. Whittaker; and John Adams as Laboratory Assistant.

Major Nation, who went overseas in 1914, returned in September, 1917, and resumed his position as general office assistant.

John D. Galloway, M.Sc., who was Assistant Provincial Mineralogist until June, 1917, when he was appointed Resident Engineer of the North-eastern Mineral District, with headquarters at Hazelton, rendered most valuable assistance in the preparation of the Annual Report.

Aside from his usual duties, the Provincial Mineralogist was occupied for four months investigating causes of breakage of wire cables, about two months of which time he was in the East, making tests in McGill University Laboratory.

During the session of 1917 the Hon. the Minister of Mines brought in the "Mineral Survey and Development Act," which was passed on May 19th, 1917, and under the provisions of which the Province was divided into six Mineral Districts, to each of which there was appointed a Resident Engineer with headquarters at a centrally located point in such district.

In the district to which he was appointed the Resident Engineer is expected to devote his whole time to the performance of the duties of his office, and to carry on continuously a mineral survey of his district, keeping records of the same and of the mining and mineral developments taking place, and at the same time to assist prospectors and others with such advice as may be necessary and may come within the scope of a mining engineer's work.

Aside from special reports which may be called for by the Minister, the Resident Engineers are expected annually to make a comprehensive report covering all matters relating to mining, mine development, and prospecting that have occurred within the year in their respective districts.

These annual reports of the Resident Engineers are given later in this general Report, and form the basis of the information given in respect to the mineral industry and its development within the Province.

The following are the six Mineral Districts into which the Province is divided, with the Mining Divisions included in each and the location of the permanent office of the district, with the name of the Resident Engineer appointed to each district:—

(1.) The North-western Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Atlin, Stikine, Liard, Skeena, Portland Canal, Bella Coola, and Queen Charlotte; and shall have its permanent survey station and office at the City of Prince Rupert. Resident Engineer, Geo. A. Clothier.

(2.) The North-eastern Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Omineca, Peace River, Cariboo, and Quesnel; and shall have its permanent survey station and office at Hazelton. Resident Engineer, John D. Galloway, M.Sc.

(3.) The Central Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale; and shall have its permanent survey station and office at the City of Kamloops. Resident Engineer, R. W. Thomson.

(4.) The Southern Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Similkameen, Greenwood, Grand Forks, and Osoyoos; and shall have its permanent survey station and office at the City of Grand Forks. Resident Engineer, Philip B. Freeland.

(5.) The Eastern Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Golden, Windermere, Fort Steele, Ainsworth, Slocan, Slocan City, Trout Lake, Nelson, Arrow Lake, Revelstoke, Lardeau, and Trail Creek; and shall have its permanent survey station and office at the City of Revelstoke. Resident Engineer, A. G. Langley, B.Sc.

(6.) The Western Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Nanaimo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver, and New Westminster; and shall have its permanent survey station and office at the City of Nanaimo. Resident Engineer, W. M. Brewer.

ASSAY OFFICE.

The following is a summary of the work of the Assay Office of the Bureau of Mines for the year 1918 as reported by the Assistant Provincial Assayer, D. E. Whittaker:—

During the year 1918 there were made by the staff in the Government Assay Office 3,472 assays or quantitative determinations; of these the majority were for the Bureau of Mines or for the other departments, for which no fees were received.

The fees collected by the office were as follows:—

Fees for analyses	$ 809 00
Fees for assaying	189 65
Fees for assayers' examinations	45 00
Total cash receipts	$1,043 65

Determinations and examinations made for other Government departments for which no fees were collected—

Attorney-General's Department	$ 467 00
Agricultural Department	300 00
Board of Health	180 00
Treasury Department	52 60
Other departments	25 00
	$1,024 60
Value of work done outside of Department work	$2,068 25

The value of gold melted during the year 1918 was $4,276 in 33 lots, as against $6,647 in 20 lots in 1917.

Free Determinations. In addition to the above quantitative work, a large number of qualitative determinations, or tests, were made in connection with the identification and classification of rocks or minerals sent to the Bureau for a report; of these no count was kept, nor were any fees charged, as it is the established custom of the Bureau to examine and test qualitatively, without charge, samples of minerals sent in from any part of the Province, and to give a report on the same. This has been done for the purpose of encouraging the search for new or rare minerals and ores, and to assist prospectors and others in the discovery of new mining districts, by enabling them to have determined, free of cost, the nature and probable value of any rock they may find. In making these free determinations, the Bureau asks that the locality from which the sample was obtained be given by the sender.

EXAMINATIONS FOR ASSAYERS.

Report of D. E. Whittaker, Secretary of Board of Examiners.

I have the honour, as Secretary, to submit the Annual Report for the year 1918 of the Board of Examiners for Certificates of Competency and Licence to Practise Assaying in British Columbia, as established under the "Bureau of Mines Act Amendment Act, 1899."

An examination was held in Victoria, in the Government Laboratory, on May 17th and the following days. Two candidates came up for examination, and one obtained the required number of marks; the Board recommended that a Certificate be granted to him. No candidates applied for exemption under section 2, subsection (2), of the Act.

A meeting of the Board of Examiners was held on December 16th in Victoria, but as there were no candidates for examination or applications for licence by exemption, it was unnecessary to hold the usual semi-annual examination in that month.

In accordance with the recommendations of the Board, a Certificate has been duly issued by the Honourable the Minister of Mines to the one candidate.

List of Assayers holding Provincial Certificates of Efficiency under the "Bureau of Mines Act Amendment Act, 1899."

(Only the holders of such certificates may practise assaying in British Columbia.)

Under section 2, subsection (1).

Adams, J. B.	Victoria.
Archer, E. G.	Anyox.
Armstrong, N.	Vancouver.
Ayres, D. A.	
Austin, John W.	
Backus, Geo. S.	Britannia Beach.
Baker, C. S. H.	
Barke, A. C.	
Bernard, Pierre	Monte Christo, Wash.
Bishop, Walter	Grand Forks.
Buchanan, James	Trail.
Buehman, A. S.	Trail.
Campbell, Colin	New Denver.
Carmichael, Norman	Clifton, Arizona.
Church, George B.	
Cobeldick, W. M.	Scotland.
Collison, H.	Cobham, England.
Comrie, George H.	
Craufurd, A. J. F.	Rossland.
Crerar, George	
Cruickshank, G.	
Davidson, J. R.	Vancouver.
Day, Athelstan	Dawson.
Dedolph, Ed.	
Dockrill, Walter R.	Chemainus.
Dunn, G. W.	Rossland.
Farquhar, J. B.	Vancouver.
Fingland, John J.	Kaslo.
Grosvenor, F. E.	Vancouver.
Hamilton, Wm. J.	Anyox.
Hannay, W. H.	Rossland.
Hart, P. E.	
Hawkins, Francis	Silverton.
Hawes, F. B.	Vancouver.
Hodgson, A. R.	Anyox.
Hook, A. Harry	Greenwood.
Hurter, C. S.	Prince Rupert.
Irwin, Geo. E.	Vancouver.
John, D.	Haileybury, Ont.
Kiddie, Geo. R.	California.
King, R.	
Kitto, Geoffrey B.	Victoria.
Langley, A. S.	Crofton.
Lee, Fred E.	Trail.
Lee, Geo. M.	Grand Forks.
Ley, Richard H.	
Levy, Frank	
Lindsay, W. W.	Kimberley.
Longworth, F. J.	Boyds, Wash.
Laucks, I. F.	Seattle.
Manning, S. M.	Trail.
Martin, S. J.	
Marsh, Richard	Republic, Wash.
Marshall, H. Jukes	Vancouver.
Marshall, William S.	Ladysmith.
Merrifeld, T. T.	Trail.
Miles, Arthur D.	
Mitchell, Charles T.	Copper Cliff, Ont.
McCormick, Alan F.	Ruth, Nevada.
MacDonald, Alec C.	Vancouver.
Morgan, Richard	Trail.
Nicholls, Frank	Norway.
Parker, Robt. H.	
Parsenow, W. L.	
Perkins, Walter G.	
Pickard, T. D.	Vancouver.
Pirrie, Noble W.	Ottawa.
Prior, C. E.	Hedley.
Richmond, Leigh	Duncan.
Robertson, T. R.	
Rodgers, Ch. B.	Vancouver.
Rombauer, A. B.	Butte, Mont.
Schroeder, Curt. A.	
Segsworth, Walter	Toronto, Ont.
Sharpe, Bert N.	
Sim, Chas. John	Monte Carlo.
Snyder, Blanchard M.	
Steven, Wm. Gordon	
Stimmel, B. A.	Trail.
Sundberg, Gustave	Mexico City.
Tally, Robert E.	Spokane, Wash.
Thomas, Percival W.	Vancouver.
Tretheway, John H.	
Turner, H. A.	Vancouver.
Vance, John F. C. B.	Vancouver.
Van Agnew, Frank	Siberia.
Vaughan-Williams, V. L.	California.
Wales, Roland T.	
Watson, Wm. J.	Ladysmith.
Watson, Thomas	Vancouver.

Under section 2, subsection (1)—Concluded.

Welsh, J. Cuthbert	Butte, Mont.	Williams, W. A.	Vancouver.
Wells, Ben T.		Williams, Eliot H.	
West, Geo. G.	Vancouver.	Williams, J. R.	Vancouver.
Whittaker, Delbert E.	Victoria.	Wimberley, S. H.	Nevada, U.S.A.
Widdowson, E. Walter	Nelson.		

Under section 2, subsection (2).

Archer, Allan		McDiarmid, S. S.	
Blaylock, Selwyn G.	Trail.	McGinnis, Wm. C.	Queen Charlotte Ids.
Bissett, D. G.	Trail.	McKay, Robt. B.	Vancouver.
Bolton, George E.	Silverton.	McLellan, John	Queen Charlotte Ids.
Brennan, Charles Victor		McMurtry, Gordon O.	
Browne, R. J.	Rossland.	McNab, J. A.	Thompson, Nevada.
Browne, P. J.	Nelson.	McPhee, W. B.	
Bryant, Cecil M.		McVicar, John	Edmonton, Alta.
Burwash, N. A.		Maclennan, F. W.	
Cavers, Thomas W.		Moran, P. J.	Vancouver.
Clothier, George A.	Prince Rupert.	Newton, W. E.	Sandon.
Cole, Arthur A.	Cobalt, Ont.	Oughtred, S. W.	Ainsworth.
Cole, G. E.	Rossland.	Outhett, Christopher	Kamloops.
Cole, L. Heber	Ottawa, Ont.	Pemberton, W. P. D.	Victoria.
Conway, E. J.	Vancouver.	Reid, J. A.	Cobalt, Ont.
Coulthard, R. W.		Ritchie, A. B.	Nelson.
Cowans, Frederick		Roaf, J. R.	
Dawson, V. E.	Trail.	Rose, J. H.	Thompson, Nevada.
Dempster, R. C.	Rossland.	Rutherford, R. C.	Trail.
Dempster, A. S.	Rossland.	Sampson, E. H. S.	Riondel.
Dixon, Howard A.	Toronto, Ont.	Scott, Oswald Norman	
Eardley-Wilmot, V. L.	Rossland.	Shannon, S.	
Eldridge, Gardner S.	Vancouver.	Sharpe, G. P.	Midland, Ont.
Galbraith, M. T.		Shorey, P. M.	Trail.
Gilman, Ellis P.	Vancouver.	Sloan, David	Three Forks.
Green, J. T. Raoul	Blairmore, Alta.	Stevens, F. G.	Mexico.
Guess, George A.	Toronto, Ont.	Stroud, J. E. C.	Anyox, B.C.
Gwillim, J. C.	Kingston, Ont.	Sullivan, Michael H.	Kellogg, Idaho.
Harding, Wilson M.		Sutherland, T. Fraser	
Heal, John H.		Sutherland, Wm.	Glasgow, Scotland.
Hearn, Roy D.	Trail.	Swinney, Leslie A. E.	
Hilliary, G. M.	Idaho, U.S.A.	Thompson, W. K.	Trail, B.C.
Johnston, William Steele	Lachine, Que.	Thomson, H. Nellis	Anaconda, Montana.
Kaye, Alexander	Vancouver.	Thomson, Robt. W.	
Kendall, George	Vancouver.	Watson, A. A.	
Kidd, G. L.	Edmonton, Alta.	Watson, Henry	
Kilburn, Geo. H.	Rossland.	Willis, F. S.	Trail.
Lathe, Frank E.	Grand Forks.	Winslow, R. H.	Vancouver.
Lay, Douglas		Wilson, Ridgeway R.	Fernie.
Lewis, Francis B.	South Africa.	Workman, Ch. W.	
Merrit, Charles P.		Wright, Richard	Rossland.
Murphy, C. J.	St. Catharines, Ont.	Wynne, Lewellyn C.	
Musgrave, W. N.	England.	Yuill, H. H.	
McArthur, Reginald E.			

Under section 2, subsection (3).

Carmichael, Herbert	Victoria.	Marshall, Dr. T. R.	London, England.
Galloway, J. D. (Resident Engineer.)	Victoria.	McKillop, Alexander	Vancouver.
		Pellew-Harvey, Wm.	London, England.
Harris, Henry	Tasmania.	Robertson, Wm. Fleet (Provincial Mineralogist.)	Victoria.
Hedley, Robt. R.	Vancouver.		
Kiddie, Thos.	California.		

PREVIOUSLY ISSUED UNDER THE "BUREAU OF MINES ACT, 1897, SECTION 12.

Pinder, W. J.		Thompson, James B.	Vancouver.

NORTH-WESTERN DISTRICT (No. 1).

Report of Geo. A. Clothier, Resident Engineer.

INTRODUCTORY.

District No. 1 includes eight Mining Divisions of the Province—namely, Bella Coola, Queen Charlotte, Skeena, Portland Canal, Nass River, Atlin, Stikine, and Liard—and embraces all the north-western portion of the Province from Seymour inlet to the northern boundary of British Columbia.

The Nass River Mining Division is a new one created on September 1st, 1918. It comprises that portion of the Skeena Mining Division from the watershed between the Nass and Skeena rivers and from the mouth of Portland inlet just south of Pearce island, north to the southern boundary of the Stikine Mining Division. The recording office is at Anyox, B.C. A portion of the production from the old Skeena Division will therefore now be included in that of the Nass River Division.

There are many features of this North-western District which make it probably the most desirable one in the Province, from an operating as well as a prospecting standpoint. The most important feature, I think, is the accessibility of the greater portion of the District. A glance at the map will convince any one that the innumerable islands and miles upon miles of waterways cutting into the mainland, for a distance of 400 miles from Seymour inlet to the head of Portland canal, furnish unlimited areas most accessible to the prospector, and eliminates the generally prohibitive handicap of the lack of transportation. Prospecting is therefore not expensive (a gun and fishing tackle will provide 75 per cent. of the prospector's grub) and is attended with less difficulties and hardships than many other districts. It is surprising how little systematic prospecting has been done along the coast and the very small portion of the total area that has been gone over; the majority of claims staked are on croppings accidentally discovered by fishermen, lumbermen, and trappers. Because of the ideal transportation conditions, the large operating companies are always in the market for, and willing to exploit, prospects of big, low-grade ore-bodies, while with high-grade smaller bodies the prospector always has the possibility of shipping his own ore.

Geologically, the distribution of the rock formations in the entire district is considered conducive to the deposition of ore. The main granodiorite batholith, constituting the core of the Coast range, extends through the district from Bella Coola to Alaska.

Within this granite range, which varies in width from thirty to one hundred miles, are enclosed many areas of sedimentary and altered rocks which are well worth the prospector's attention. The immense deposit on the Ecstall river of iron pyrites, carrying a small percentage of chalcopyrite with small gold and silver values, occurring in a belt of sedimentary rocks about a mile wide, contained in the Coast granodiorite, exemplifies this class of ore-deposit. Also, within the granite are many intrusions or dykes of igneous rocks, along or in the vicinity of which are conditions favourable for the circulation of mineral-bearing waters and the deposition of their contents, such as is found in the *Drum Lummon* property, now under development, on Douglas channel. There are also many zones of shearing action in the granites which have rendered the rocks open and porous, and thus suited to water-circulation and to the deposition of such ore-bodies as those found in the Belmont-Surf Inlet Mines Company's property on Princess Royal island. A fourth characteristic deposit is the filled fissure in the granite; such veins as those of the *Dardanelles* group on Zymoetz (Copper) river and the *Outsider* group at Maple bay, on Portland canal, are examples of valuable deposits of this class.

Bordering the main granite-mass on either side is a broad belt of altered sedimentaries, with unaltered sedimentaries farther away from the contact, through which have intruded dykes of all kinds, spurs, isolated peaks, and short ranges from the main granite batholith, throughout which are ore-deposits of every description. This district includes the west contact-zone, from Bella Coola north to the mouth of Portland inlet, on the southern boundary of the Alaskan strip. The east contact-belt extends from the Zymoetz (Copper) river near Terrace, on the Grand Trunk Pacific Railway, north to the Alaska-British Columbia boundary-line.

The Coast range is penetrated to the eastern contact by the Skeena river, the Nass river, Portland canal, and Observatory inlet, and through the Alaska strip by the Unuk river, the Stikine river (with its principal tributary, the Iskut), and the Taku river, admitting of a lot of prospecting north of the Portland canal. The value of the eastern contact has already been demonstrated by the discovery of such properties as the *Hidden Creek* mines of the Granby Consolidated at Anyox; the *Dolly Varden* and others in the Alice Arm country; the *Bush*, *Big Missouri*, and others of the Salmon River section of Portland canal; and the *Engineer* mine in the Atlin district. It should be noted that, almost without exception, the ore-bodies occur in the greenstones or andesites, more or less altered where mineralized, and carry all the mineral-bearing metallics, such as gold, gold-silver, silver-lead, gold-copper, copper, and silver.

PRODUCTION FOR 1918 FROM DISTRICT NO. 1.

Shipper.	Ore mined.	Gold.	Silver.	Copper.
	Tons.	Oz.	Oz.	Lb.
Granby Consolidated Mining, Smelting & Power Co.	857,871	5,934	381,859	29,692,376
Belmont-Surf Inlet Mines, Ltd.	97,830	41,618	27,326	432,313
Ikeda Mines, Ltd.	210	58	795	62,933
Lucky Seven (Terrace)	100	200	.....	.....
Black Bear (Alice Arm)	13	.....	2,700	.....
La Rose (Alice Arm)	11	1	1,543	.....
Salmon-Bear River Mining Co.	26	182	182	.....
Maid of Erin (Rainy Hollow)	25	.....	875	11,160

The total value of the lode mines of this district amounted in value to $9,044,925.

The value of the mineral-output of the North-western District has increased from $2,006,577 in 1914 to $8,405,696 in 1917. The production for 1918 was 866,304 tons, producing 30,201,766 lb. copper, 48,462 oz. gold, 417,731 oz. silver, having a total value of $9,044,925, an increase of $639,229 over last year. The increase in copper production for this year was due to the greater output of the Granby Consolidated and the production of nearly 500,000 lb. by the Belmont-Surf Inlet Mines, Limited. The greater gold production is due to the Belmont-Surf Inlet Mines, Limited, whose output for the year was over 41,618 oz.

The outlook of the mining industry in No. 1 District for the future is exceptionally favourable; several properties have been proven to the shipping-point, and the coming year should show a marked increase of production. The adjustment of the Dolly Varden railroad difficulties will put the Dolly Varden Mines Company on the shipping-list, together with several small shippers in that section. The Portland Canal Division will have a shipper in the *Bush* property from now on, with two or three other properties showing up well with development. The *Engineer* mine, in the Atlin Division, may also be expected to become an important gold-producer, probably within the coming year. The above-mentioned sections will greatly increase the silver-gold output.

With the war over and the return of many of the men who have enlisted from this north country, together with others who are well fitted for the life and are alive to the many opportunities of this particular portion of the Province, I look for an extensive revival of prospecting and mining activities.

The following review of the prospects, mines, mining conditions, and activities will be considered, for the purposes of this report, under the following headings:—

Bella Coola Mining Division.

Queen Charlotte Mining Division.

Skeena Mining Division—Coast Section; Grand Trunk Pacific Section; Kitsumgallum Valley Section; Lakelse Valley (Thornhill Mountain) Section.

Nass River Division—Alice Arm Section; Kitsault River Section; Illiance River Section; Observatory Inlet Section.

Portland Canal Division—Portland Canal Section; Bear River Section; Salmon River Section.

Stikine Mining Division.

Atlin Mining Division—Rainy Hollow Section; Atlin Section.

BELLA COOLA MINING DIVISION.

I had the opportunity of examining only one property in this Division during the year. I am informed that there has been very little active mining, but that options have been secured on several claims by one of the large operating mining companies, which will commence work at an early date.

A group consisting of three claims is situated at the head of Evans arm, on King island, about twenty miles from Ocean Falls. The group belongs to J. A. Pauline, of Bella Bella; Mr. Smabey, of Ocean Falls; and others.

The showing is a mineralized belt of basic intrusives in the granodiorites, consisting of bands of magnetite, hornblende, feldspathic rock, streaks of quartz, greenstone, etc., some of the magnetite being sparingly mineralized with chalcopyrite. The only work done is the stripping of the showing and a shot put in here and there where the magnetite crops. A cross-section of the outcrop 60 feet wide shows 2 feet of magnetite on the foot-wall; then 6 feet of dyke-rock; then 3 feet of dyke with bunches of magnetite in it; then 10 feet of dyke; the balance of mixed rock with bands and bunches of magnetite.

The zone appears to strike about with the arm, N. 10° E., and not more than 100 feet depth could be obtained for some distance by drifting, as the ground at the head of the arm is low.

A sample of the best-looking iron assayed: Iron, 52.5 per cent.; sulphur, 0.31 per cent.; phosphorus, trace; insoluble, 11.9 per cent.; copper, 0.2 per cent. The showing justifies more work.

I have no information as to the work done on the *Alexander* group or the *Kitchener* group, both magnetite-showings, on Seymour inlet, mentioned in last year's report.

QUEEN CHARLOTTE MINING DIVISION.

The lumbering industry, in the production of aeroplane spruce, requiring the employment of a great number of men, has resulted in considerable prospecting for mineral being done and some little mining activity.

The beach placers on the north coast of Graham island have been worked to some extent by Mr. Flynn and associates, but no gold production has been reported as yet.

A centrifugal-action gold-amalgamating machine invented by a Mr. Haskell, of Seattle, Wash., was installed early in the spring on three leases owned by R. R. Smith. This ground is situated at the old mouth of the Oeanda river, on the east coast of Graham island, about forty miles north of Skidegate. The principle of the machine is along the lines of a cream-separator. About 15 lb. of mercury is placed in the bottom of a double conical drum having a greatest diameter of 16 inches. The drum, revolving at from 750 to 850 r.p.m., causes the mercury to rise to the inner circumference of the drum and form a ring around it. Sand and water in the proportion of 1 to 3 are pumped into the top of the machine against an inverted dome provided with three knuckles or projections which break up the flow of sand and distribute it all over the drum. The centrifugal motion then forces the heavier-than-sand particles of gold into the ring of mercury, where it is amalgamated. The heavier particles of platinum, if present, will be forced through the mercury and collect on the drum. The sand will be forced down by the incoming feed and discharge at the bottom. The clean-up is made by stopping the machine and removing the amalgam.

The machine is driven by a 12-horse-power Witte gas-engine and is supposed to have a capacity of 300 tons in eight hours. I have been informed that the inventor was called in the United States Army draft, and that the machine has therefore not been in operation yet.

The owners of the ground claim to have proven to their own satisfaction that the sand will average 60 cents to the yard, some of it running as high as $4 a yard. No platinum has been found in this ground, but about three miles farther south, on three leases owned by Mr. Ferguson, some platinum is obtained in the concentrated black sand.

The trial of the machine described will be of great interest, and, if successful, will prove very profitable on the grade of sand, as the cost of operation is small.

The South Easter Mining Company is a subsidiary company of the Northern Customs Concentrators, Limited, of Cobalt, Ont. A. S. Holmes is manager of the operations on the islands.

The property consists of seven claims—namely, *South Easter*, *Lion*, and *Triangle Fraction*, originally owned by McLellan, Gordon & Bourne, and the *Blue Jay*, *Cobalt*, *North Bay*, and *Toronto*, staked by the present Company. The first three claims, the original *South Easter* group, are Crown-granted. The seven claims are situated about one mile from the Indian village of

Skidegate, at the entrance of Skidegate inlet, along the northern boundary of the Indian Reserve. A fair wagon-road suitable for taking in the machinery was built by the company with Government assistance. The road would have to be altered and improved for hauling out ore.

There are three quartz veins on the property, only one of which, however, shows commercial value. The values are in gold, about 40 per cent. of which will amalgamate; some very rich ore has been sorted out from development-work. The three veins are contained in a fissured zone about 30 feet wide in a diabasic rock formation. The one carrying the gold values, on which the development-work has been done, is traceable on the surface for over 1,000 feet, averaging in width from 8 to 10 feet, and in values from $12 to $15 a ton.

A shaft has been sunk on this vein for 100 feet and two levels driven from it; one is at 50 feet depth, 50 feet to the west and 75 feet to the east; the east drift showing a good shoot of ore. Another level is at 100 feet depth, with drifts of 100 feet west and 250 feet east on the vein, which is small and carries low values; the ground on this level is badly shattered, probably on account of the convergence of the veins. A raise was run from the east drift to tap the ore-body exposed on the 50-foot level above. It would appear that the ore-shoot, cropping on the surface, extends about 65 feet down and averages about 5 feet in width. It is the intention of the company to explore the fissured zone to a further depth either by sinking the shaft or by diamond-drilling. From the extent of the showings I think such work fully justified.

The property has been equipped with a very efficient small plant, consisting of a Chicago Pneumatic Tool Company compressor of 198 cubic feet a minute capacity, of semi-Diesel type, burning about 30 gallons of fuel-oil per eight-hour day. Fuel-oil costs 25 cents a gallon at the property. The hoist, assay office, and machine-shop are all in one building. A good bunk and cook house and manager's residence have been built. One-man Denver "Clipper" machines are used in development. The owners have every confidence in the property and hope to develop a sufficient tonnage to warrant the erection of a concentrating plant.

Producer Group. This group, formerly the *Lucky Seven*, is situated just outside of Jedway harbour and owned by Ike Thompson and Wilson McKinnon. It is now under option to Seattle interests, who have installed a water-driven compressor, and will this winter drive a tunnel from the beach to crosscut the ore showing on the surface. Considerable work has been done previous to the present programme, consisting of open-cuts and stripping and a shaft sunk 50 feet on the vein, from which a drift was run south for 60 feet. This drift shows an average width of 18 inches of good copper ore carrying fair values in gold and silver, averaging about $30 a ton. The proposed tunnel would be about 300 feet long and give a depth on the vein of about 100 feet. There are good reasons to expect this property to develop into a fair producer.

Ikeda Mines. The Ikeda Mines, Limited, property is comprised of fifty-seven claims, all Crown-granted with the exception of two. The group is situated around Ikeda bay, on Moresby island. The property has been controlled since 1910 by a Vancouver syndicate, during which time there has been done 2,000 feet of diamond-drilling, mainly from No. 3 tunnel; 300 feet of drifting, crosscutting, and raising; 110 feet of sinking from No. 3 tunnel, with 20 feet of drifting on the vein from the bottom of the winze, and 138 feet of a crosscut from the bottom of the winze towards a parallel vein which forks from the main vein. A small stringer of ore was cut at 92 feet in the crosscut, which would correspond to the small vein above. The winze is 270 feet from the mouth of No. 3 tunnel.

The property has been developed by three tunnels, which constitute the main workings, and another tunnel up the hill. The main working-tunnel, No. 3, is at an elevation of 264 feet above sea-level and has been driven on the vein for 660 feet; 360 feet of that distance from the mouth of the tunnel being on No. 1 ore-shoot, which has been stoped through to the surface from two levels above—No. 2 and an intermediate level between No. 2 and No. 3. Farther in the tunnel No. 2 ore-shoot was opened up by crosscuts from the main tunnel and drifting on the shoot. This opened up at the end of the tunnel into the "big chamber," which is about 100 feet long and 40 feet wide, of mixed ore, the average of which will assay, approximately, 2.5 per cent. copper, and contains bands of chalcopyrite from which a considerable tonnage has been mined and hand-sorted to a shipping grade of about 15 per cent. copper, with some gold and silver.

A short distance from the mouth of the No. 3 tunnel a drift was started on and followed a small parallel vein of high-grade chalcopyrite ore, in places 3 feet wide, of clean ore, lying in

a dioritic dyke. This drift is 380 feet in length, joining the main vein again farther in the tunnel. Several thousand tons of ore has been shipped from this small, high-grade vein.

The main vein follows the contact between the diorite dyke on the foot-wall and limestone on the hanging-wall, striking about north and south (mag.) and dipping to the east at from 25 to 45 degrees.

An open-cut on the surface above No. 1 tunnel shows the vein in contact with the limestone to contain 3 or 4 feet of magnetite carrying pyrite and chalcopyrite; then 2 feet of altered and silicified dyke-rock with disseminated chalcopyrite, while lying on the diorite foot-wall is a band of sulphides, mainly chalcopyrite with a little pyrite and pyrrhotite. In No. 3 tunnel the main vein is shown to be an irregular, broken-up mass of basic wall-rock in which are fillings of sulphides.

The winze shows the main vein to be small, but, as only 20 feet has been drifted on it yet, it seems reasonable to expect that further work will disclose ore-shoots similar to those stoped above No. 3 tunnel. All the mining has been on the *Lily* claim.

About half a mile from the beach, on the *Chrysanthemum* claim, is a big showing of magnetite which has been crosscut on the surface, showing a width of 30 feet. The magnetite carries pyrite and pyrrhotite with a little disseminated chalcopyrite, and lies between walls of a basic igneous rock. Vein strikes north-south.

On the *Lotus* claim, at 475 feet elevation, a tunnel has been driven 120 feet, crosscutting a vein of pyrrhotite with some pyrite and scattered chalcopyrite. At 75 feet in the tunnel the vein appears to lie flat and consists of 6 feet of pyrite overlying a belt of from 6 to 10 feet of silicified and pyritized rock, and all showing a little chalcopyrite. This vein also strikes north and south and dips 25 degrees to the east. The surface above the tunnel shows a vein width of 24 feet, but the walls are not defined, the greater portion of the vein being solid pyrite and pyrrhotite with bands of siliceous rock, in which chalcopyrite is sparingly disseminated. Very little copper shows in the massive iron sulphides.

The property has got to the stage where it is hardly profitable to mine the lower-grade ore and hand-sort it to a shipping grade. An initial, small concentrator is required to treat the tonnage of second-class ore on the dumps, amounting to probably 5,000 tons, and the low-grade ore developed in the "big chamber," which could be very cheaply mined now. An estimate of the tonnage available from the "big chamber" and the balance of the mine would be difficult to make, but one can safely figure between 7,000 and 8,000 tons, sufficient to feed a 50-ton mill for a year. A small flotation plant would meet the requirements very nicely.

The main tunnel, No. 3, should be driven ahead to get under the cropping at No. 1 tunnel, and drifts should be run from the bottom of the winze both ways on both veins. It is reasonable to expect that exploration on the showings on other claims will also furnish ore of a milling grade.

I am indebted to Mr. Ikeda, under whose management the property has been operated during the year, for the following statement of output:—

193 tons shipped to Granby; returns received: Copper, 57,404 lb.; gold, 51.5 oz.; silver, 696 oz.

15 tons shipped to Granby; returns estimated: Copper, 4,980 lb.; gold, 4.5 oz.; silver, 58.5 oz.

150 tons shipped to Granby; returns estimated: Copper, 21,000 lb.; gold, 21 oz.; silver, 231.8 oz.

Total, 358 tons: Copper, 83,384 lb.; gold, 77 oz.; silver, 987 oz.

Hope Group. This group of two claims—*Hope* and *Hope Fraction*—owned by Hugh McEachern, is situated about a mile northerly from the head of Houston inlet, on Moresby island. An open-cut at 290 feet elevation has exposed a vein, about 20 feet wide, composed of magnetite and titaniferous iron (ilmenite), with a little pyrite, pyrrhotite, and chalcopyrite. The vein strikes N. 43° E. and dips about 74 degrees to the east. A sample across 10 feet of the face exposed by this open-cut gave assay returns of 2.7 per cent. copper, a trace of gold, and a trace of silver. There are some bands and bunches of good copper ore, but the above values will be about the average. Another open-cut farther south shows about the same vein contents. Just above the upper cut a broad acidic dyke, rhyolitic in appearance, cuts across the vein at N. 15° E., but seemingly does not affect the continuity of the vein. The showing could be opened up by drifting on it from a point about 150 feet lower than the open-cut and is worth investigation as a concentrating-ore.

Another parallel vein has been exposed at an elevation of 200 feet showing 15 feet in width of magnetite, but the copper content is lower than in the other vein.

The property is well located, Houston inlet being deep water, with plenty of timber, and water for everything but power.

Copper Island.

This island, situated just outside of Jedway harbour, contains three claims—*Golden Gate*, *Skincuttle Entrance*, and *Trust*—owned by A. Heino, who has, each year for several years, sorted and shipped a few tons of chalcopyrite ore. The vein or ore-zone extends the full length of the island, about 1,400 feet, on which a depth of about 200 feet could be obtained at the highest point without sinking. A tunnel has been driven 135 feet at about high-tide level, the face showing 4 feet in width of chalcopyrite, disseminated and in bunches, in a silicified limestone which appears to lie on the foot-wall of an extensive hornblende-belt from 20 to 30 feet wide, which extends the length of the island. Wherever this hornblende has been broken into there appears bunches of and scattered chalcopyrite. An average sample across the face of the tunnel assayed 3.5 per cent. copper.

I think the hornblende-belt is well worth exploration, for the ore would make an ideal concentrating-feed. Sufficient water could probably be developed in a low, swampy portion of the island for any milling purposes. The island is heavily timbered.

Swede Group.

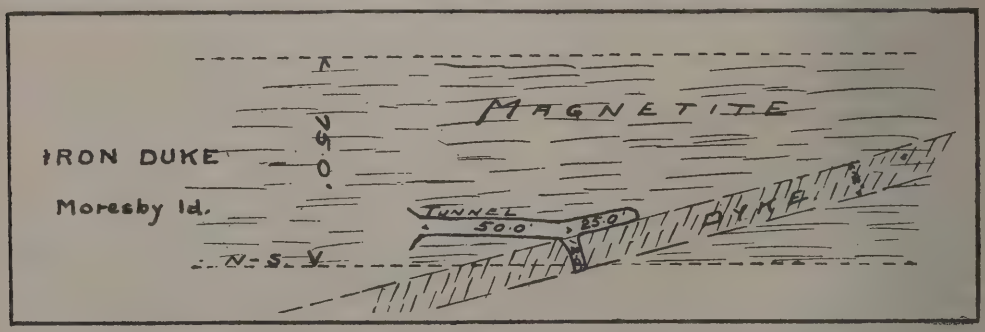
This group, consisting of eight claims, is one of the oldest groups in the district, and still owned by the original stakers, Larsen, Pearsen & Rogers. The claims cover the hill just to the left, entering Lockeport harbour. The rock formation is a diabase, throughout which is disseminated chalcopyrite and, in places, small veinlets and disseminated bornite. Two tunnels have been driven into the hill, the longest, 170 feet, showing scattered chalcopyrite all the way, but sparingly mineralized in places. An average of the whole length of tunnel would probably assay between 1 and 1.5 per cent. copper. About 200 feet north is another tunnel, 80 feet long, showing the same character of rock and mineralization, with the addition of scattered bornite and seams of the same mineral in places.

A diamond-drill hole from the face of the short tunnel for a distance of 80 feet into the hill, and some 2,000 feet of diamond-drilling on the opposite of the hill, was done by the Granby Consolidated Company. No information is available as to results obtained.

There is abundant water-supply for power and wash purposes from two creeks, draining several lakes above, emptying into the head of the inlet on which the property is situated. All conditions are ideal for working on any desired scale.

Jones Group.

This group, owned by A. Jones, consists of four claims—*Last Chance*, *No Doubt*, *Star*, and *Tiger*—situated about a mile from the head of Klumkwoi bay, on Salmon creek. The rock formation and ore occurrence are identical with that of the *Swede* group. A tunnel at an elevation of 225 feet has been driven 25 feet through the diabase, which is here low grade in copper, assaying probably about 1 per cent. Another tunnel 200 feet west of this has been driven 5 feet in the same kind of material. The Granby Company also diamond-drilled this property, with apparently unsatisfactory results.



Iron Duke Group.

This group consists of nine claims—*Iron Duke*, *Iron Duke No. 1*, *Iron Duke No. 2*, *Iron Duke No. 3*, *Simcoe Fraction*, *I.X.L.*, *Derby*, *Garfield*, and *Epsom*—situated on Louise island. The property is owned by Rogers, Benson & Larsen, the latter only owning a small share. The camp, which is on the claims, is at an elevation of 625 feet and is about an hour's walk from the beach camp on the Cumshewa

Inlet side of the island, where there is a good landing-beach. There is a good foot-trail from the beach to the camp on the property, built and maintained by the owners.

The showing on the claims consists of a big body of magnetite lying along the contact between the igneous formation on the one side and limestone on the other. Numerous light-coloured, later dykes cut across the ore-body, but do not disturb it in any way. The work done consists of a tunnel 75 feet long, with a crosscut from a point 50 feet from the mouth, across a dyke 12 feet. The tunnel is in ore all the way, but it is broken up and oxidized more or less along the dyke, which pinches out at the face in the back of the tunnel. If the tunnel was continued along the dyke it would probably run out of the ore-body, for to all appearances the dyke cuts across the ore. The tunnel is at an elevation of 1,025 feet. There are a number of open-cuts across the ore above the tunnel. The first one, 50 feet above the tunnel, shows a width of solid ore of 50 feet. Another open-cut 50 feet farther up exposes a width of 60 feet of solid magnetite. Farther up the hill another 50 feet an open-cut shows a width of 75 feet of solid ore, while 100 feet farther the vein is again opened up across 75 feet of solid ore. At 1,300 feet, or 300 feet above the tunnel, a small trench run into the ore shows it to be solid magnetite.

A sample was taken across 75 feet of solid ore at an elevation of 200 feet above the tunnel, which gave the following returns: Iron, 57 per cent.; silicia, 6.5 per cent.; sulphur, trace; phosphorus, trace.

Below the tunnel, about 100 feet, a small stripping exposes solid ore. The tonnage has not been proven to any extent yet, but it certainly has all the appearance of being an immense body of ore, which could be quarried out and shipped very cheaply.

There is an abundance of timber and plenty of water for all purposes except power.

Homestake

This group, situated on the north side of Cumshewa inlet, was reported on by Forbes in the 1913 Minister of Mines' Report, and, as no material change has been made in the property since, I will refer the reader to that report.

Shuttle island, situated nine miles south of Lockeport, is about two miles long and about half a mile wide. It was completely staked early in the spring when a cook in the logging camp discovered free gold in the gravel on the beach. Later on, free gold was also found contained in small quartz stringers running through the slaty country-rock. The placer gold found in the gravel is flat, with slightly rounded edges, showing that it has undoubtedly been freed by the disintegration of the quartz stringers, and purely local. Pieces up to $15 in value were found on the beach. My latest information is that the beach, staked as a placer claim, has been sufficiently tested to warrant its being worked. As there is no great extent of beach, only a small production may be expected.

Aeroplane.

On the *Aeroplane* claim the quartz stringers were followed for only a few feet in the slate and disappeared. A little gold was obtained by mortaring up the rock and panning it. The rock formation consists of bands of limestone, bedded slates in thin layers, and slates of more massive structure, the latter appearing to contain the quartz stringers in which the gold is deposited, as well as being slightly pyritized. The general formation strikes at about N. 15° E. and dips at 70 degrees to the east. A sample across 6 feet of the pyritized slates or argillites, showing no quartz stringers, gave returns of only a trace each of gold and silver. I understand that a shaft is being sunk about 30 feet back from the beach on the vein or band in which the gold was first discovered.

About 80 feet west of the above showing another band of slates appears, carrying more quartz than the other and in which small amounts of free gold were also found. It strikes N. 30° E. and would therefore join the other up the hill. A sample of the most pyritized pieces was taken across 18 feet, but gave no returns in gold or silver. From the exposures of mineral so far the showings are unimportant.

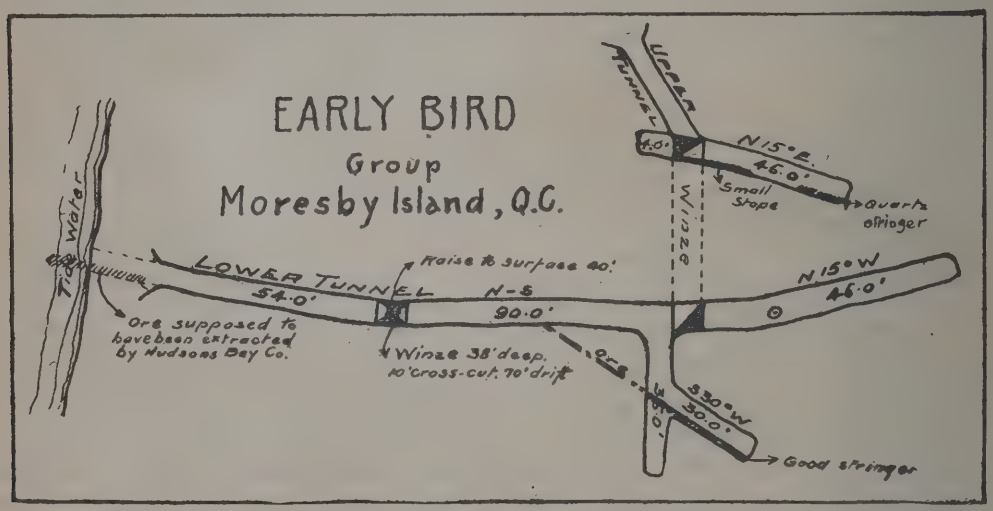
Early Bird Group.

This group of four claims is situated on the west coast of Moresby island, on Gold harbour. The claims have been owned and worked by J. McLellan for a number of years. The showing is a small quartz vein, in places lying in a greenstone country-rock, and in other places forming the cementing material in a broken-up siliceous rock lying in the greenstone. Apparently the quartz is a filling of a fissure in the greenstone, in some places impregnating and silicifying the walls for a few inches on each side of it. The quartz carries values in visible free gold; none was seen other than in the quartz.

Two tunnels have been driven; the upper tunnel, at 50 feet elevation, being 25 feet of a crosscut from the surface to the vein and a drift of 44 feet on the vein. A shaft 35 feet deep

was sunk from the surface to this level, and continued in a winze to the lower level. A little ore was stoped from the upper tunnel, from the shaft in toward the face. The lower tunnel, 10 feet above sea-level, has been driven 216 feet on the fissure. At 54 feet from the portal a winze was sunk 38 feet, a crosscut then run 10 feet to the vein, and a drift on the vein of 70 feet. There is said to be good values in this lower drift, but it and the winze were full of water to the lower tunnel-level. At 144 feet from the mouth of the tunnel the winze from the upper tunnel connects with this level.

At 87 feet in, or 33 feet beyond the winze below this level, a quartz stringer breaks off to the right, to tap which a crosscut was run 18 feet from a point farther in, and it was then drifted on for 30 feet. This stringer strikes at S. 30° W. This tunnel is equipped with car and rails. From the mouth of the tunnel to below sea-level it is reported that the Hudson's Bay Company took out several thousand dollars in free gold in early days; in fact, I believe this was the first gold discovery on Queen Charlotte islands.



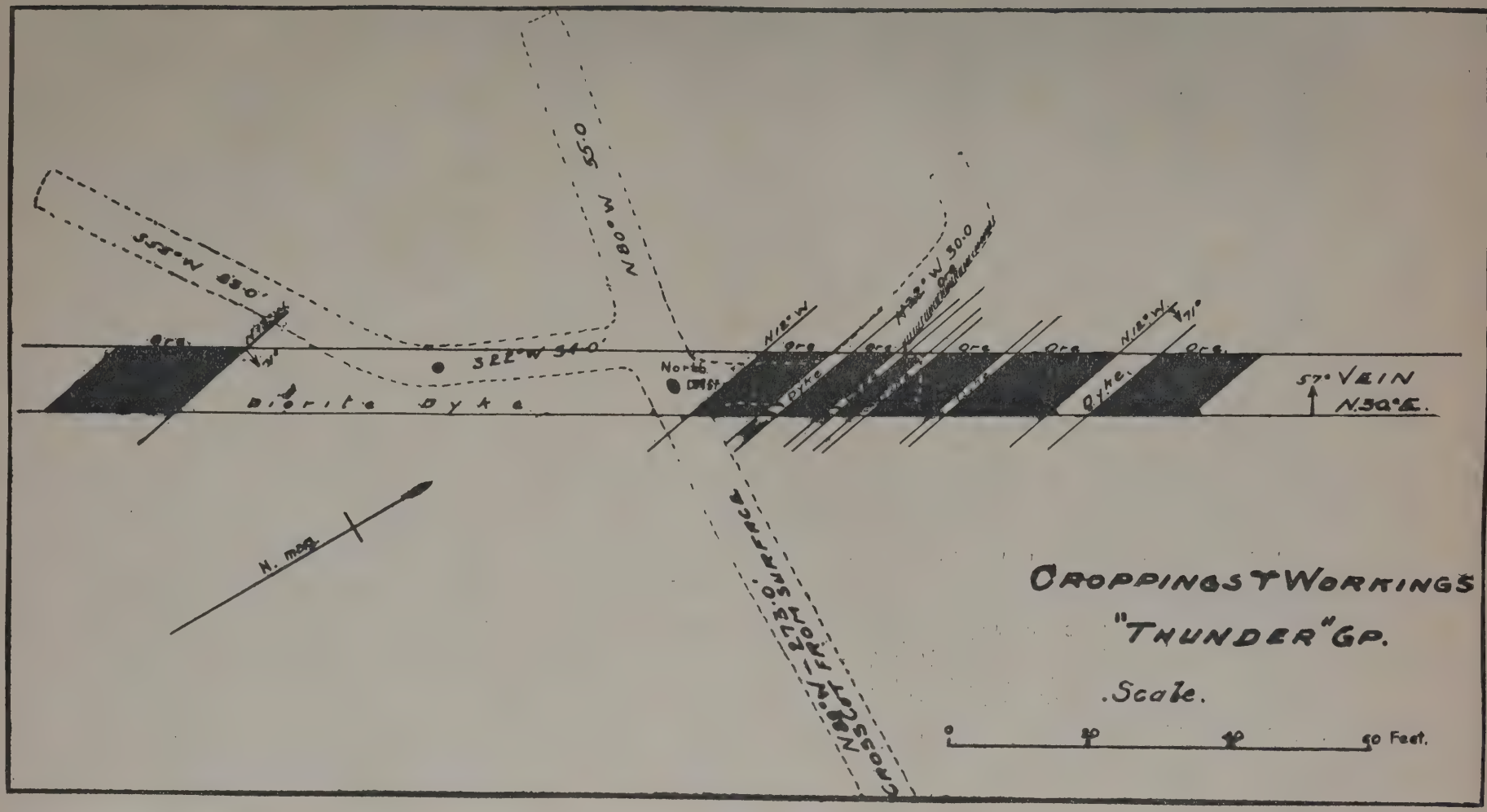
The 3-stamp mill has a small storage-bin at the head discharging on to a sorting-platform, from which the ore is shovelled into the mortar. Water-power is furnished by an 8-inch wooden pipe to a 3-foot Pelton water-wheel, giving a 100-foot head; but the water-supply is very uncertain, depending on the rainfall. In eight hours the mill treats about 800 lb. of ore sorted to about $40 a ton. Good camp buildings, mill building, and blacksmith-shop are on the beach.

Development-work to date has shown only a small vein of quartz, averaging only a few inches in width, and said to average about $6 a ton in gold, taking visible gold-bearing quartz with the barren. The incentive for development has been the possibility of striking a pocket similar to that extracted by the Hudson's Bay Company.

Thetis Group. This group, across the inlet from the *Early Bird* group, consists of eight claims—*Slide 1*, *Slide 2*, *Thetis 1*, *Thetis 2*, *Thetis 3*, *Thetis 4*, *Thetis 5*, and *Thetis 6*—staked this year by Mason, Higgins & Wiggs, of Queen Charlotte City. Slides have cleaned off the overburden, exposing stringers of quartz in a greenstone formation similar to the *Early Bird*, and on these the owners intend doing some work.

Caesar Group. This group consists of four claims—*Caesar 1*, *Caesar 2*, *Caesar 3*, and *Caesar 4*—located two wide, up the hill above the *Early Bird* group, and very likely containing a continuation of that showing. No work has yet been done. The owners are Mason, Wiggs, Hicks & Verheyden.

Thunder Group. This group, at Collison bay, on the south-eastern side of Moresby island, consists of three Crown-granted claims—*Thunder*, *Sadie*, and *Spade Flush*. The group is owned by Ike Thompson, of Jedway, B.C. Development-work to date consists of several open-cuts and strippings to expose and trace the vein. This surface work follows the outcroppings for 500 or 600 feet and shows the vein to be from 6 to 10 feet in width, although the hanging-wall has not been definitely located anywhere. The ledge strikes about N. 30° E. and dips into the hill at 55 degrees to the west. (*See* sketch.) Numerous dykes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S.S.E. FROM SURFACE

cut diagonally across the vein at about an average strike of N. 12° W. and dip east at 71 degrees. These dykes seem to be the cause of all the difficulty in following the vein underground. There does not appear to be any faulting or slipping of the vein along the dykes. The vein-filling is composed mainly of magnetite in which are some quartz, garnetite, and pyrite, with chalcopyrite fairly well disseminated and in bunches. A cross-section of the vein exposed on the surface is shown in the attached sketch.

Two hundred feet vertically below the croppings, at 650 feet elevation, a crosscut tunnel on a bearing of N. 89° W. has been driven a distance of 330 feet into the hill. This encounters the ledge at 273 feet from the portal of the tunnel. At this point the vein shows in-place on the right-hand side, but only in scattered bunches of ore on the left side. A drift of 34 feet was run north on the ore, but ran out of it, apparently into one of the cross-dykes. At a point in this drift 26 feet from the crosscut a crosscut was driven a distance of 30 feet to the left, following a streak of ore which may be a slight mineralization along the wall of one of these dykes. I think if the drift was continued it would pick up the ore again after going through the dyke.

On the south side of the main crosscut a drift of 34 feet was run without encountering any ore. It is evident from the diagram that this drift is entirely driven in a broad dioritic dyke. This summer the property was bonded to Seattle people, who ran the crosscut mentioned above as following along the wall of a dyke. They also continued the 34-foot drift on the south side a further distance of 83 feet, turning a little more to the west, and consequently in the hanging-wall country-rock all the way. If the property was surveyed and the underground workings tied in with the surface showings, I think there would be no trouble in picking up the ore on the south side of the main crosscut.

A sample taken across the vein for 6 feet 6 inches at a point 30 feet in on the north drift from the main crosscut gave: Copper, 2.6 per cent.; silver, 3 oz.; and gold, 80 cents a ton. Another across the vein for 6 feet on the surface in an open-cut directly above the tunnel gave: Copper, 2 per cent.; silver, 0.7 oz.; and gold, $1 a ton. In an open-cut 200 feet south of the above sample, across 6 feet, showing magnetite and chalcopyrite, a sample gave returns of: Copper, 1.5 per cent.; silver, 0.8 oz.; and gold, $1.20 a ton.

The property is very favourably situated for mining and transportation, and I think the showings sufficient to warrant further exploration.

Meal Ticket Group.

This group consists of three claims—*Meal Ticket*, *Treasure Box*, and *Treasure Vault*—situated south of and adjoining the *Thunder* group. The property is owned by George D. Scott, of Vancouver, B.C. The rock formation is a diorite, the same as the *Thunder* group. The showing consists of a vein of magnetite 8 feet wide, carrying considerable pyrrhotite with some pyrite and chalcopyrite. It is exposed for 200 feet in length on the surface, striking north and south, showing some shipping-grade copper ore.

At an elevation of 275 feet a tunnel was driven 30 feet, crosscutting the vein, which here shows a width of about 8 feet. There is a considerable pile of ore on the dump from this work. The tunnel is about 3,500 feet from the beach, and a further depth of 100 to 150 feet could be obtained on the vein by crosscutting from the creek-bottom, which would give a water-grade to the beach. The ore appears to grade into the diorite going north, but no work has been done on this portion of the showing. There is some fine-looking ore on the surface, and, although not proven, might easily open up into a shoot of shipping ore. There is a good chance to explore the vein by diamond-drilling. Machinery would be necessary for satisfactory development on account of the hardness and toughness of the rock.

Wireless.

This claim, owned by Daykin Bros., is situated on the west side of Collison bay. A crosscut tunnel 51 feet long, of which 15 feet is an open-cut, has been driven from just above tide-water to the vein, showing it to be a limestone-belt about 4 feet wide lying in a diorite country-rock. Throughout the lime is sparingly disseminated chalcopyrite and bornite, evidently a secondary sulphide obtained from the surrounding igneous rocks. The vein strikes N. 25° E. and dips north-west at 53 degrees. The low values do not warrant very much development.

Collison Bay.

The old Collison Bay Mining Company did a lot of work on a property, since abandoned, about a mile from the beach at Collison bay. Two levels were opened up, connected by an incline. The upper level is a crosscut 100 feet

long from the surface to the vein and a drift of 100 feet on ore. About 50 feet of work was done on the lower level, with no ore showing. The vein is characteristic of the surrounding showings, being magnetite with pyrrhotite, pyrite, and scattered chalcopyrite. The whole dump would probably assay between 1 and 1.5 per cent. copper. A tramway right-of-way was cut out from the tunnel to the beach.

The oilfields* on the west coast of Graham island are again receiving some little attention, though no actual drilling has been commenced. I made a trip around the north and west coasts last spring, landing where weather conditions would permit. The first anchorage on the west coast was inside of Frederick island. This area was examined, both on Frederick and Graham islands. There is an area here, about 2,000 feet wide and about a mile in length along the beach, consisting of banded argillites, sandstones, limestones, and tuffs, designated by MacKenzie as the Maude formation. The general strike is about north and south, with an average dip of probably 30 degrees, although the beds are locally twisted and folded in all directions. The length and dip of this formation would give an approximate thickness of 2,500 feet. Some layers of a soft, tarry substance were noticed along the shaly bedding-seams and the cross-joints. Bands of fossiliferous shales occur, especially in the lower portion of the formation.

It was impossible to land at Tian bay, where the drilling had been done, because of a strong south-wester and a heavy surf. A landing was made at Port Louis, but no indications of oil were seen, the formation consisting of basalt flows and agglomerates of the Masset formation, as at Tian and Otard bays. At the head of Rennell sound, for a width of about two miles, occurs practically the same formation and indications as at Frederick island. The shales strike N. 60° E. and dip at 60 degrees, somewhat more perpendicular than on the north-western side of the island.

I consider that there were no striking indications of oil at any place I landed, and, furthermore, the structure of the formation was never favourable enough at any place to justify one in thinking that it might be the container of an oil-reservoir. I admit that the points at which I was landed were too isolated from each other to form any definite conclusion, and I think that this whole section should be thoroughly investigated by a competent oil geologist, who would then have the necessary data and information to enable him to correlate the areas, which are, as yet, widely separated and in themselves unfavourable for further drilling.

SKEENA MINING DIVISION.

This Mining Division has for the past two or three years held first place in mineral production amongst the Mining Divisions of the entire Province. This was due to the output of the Granby Consolidated Mining, Smelting, and Power Company, whose production will now be included in the new Nass River Division, which will therefore have the distinction of having the largest output of the Mining Divisions.

For convenience the Division will be subdivided as follows: Skeena Mining Division—Coast Section; Grand Trunk Pacific Railway Section; Kitsumgallum Valley Section; Lakelse Valley (Thornhill Mountain) Section.

Coast Section.

Surf Inlet.

The Belmont-Surf Inlet Mines, Limited, property was pretty thoroughly described in the 1917 Minister of Mines' Report; consequently it will be unnecessary to go into details, except to supplement that report with operations and development of this year. The mine and plant have been in continuous operation throughout the year, and it certainly reflects credit on the business management of the company that they have done so without a murmur, under conditions which have called forth protests from the majority of the gold-producing properties on the continent.

They have mined this year approximately 80,000 tons of ore, which has produced 8,209 dry tons of concentrates, shipped to Tacoma, and yielding 41,618 oz. gold, 27,326 oz. silver, and 432,313 lb. copper, a very creditable output for the first year's operations.

The important underground work of the year has been the opening-up of the winze which had been sunk from the 550-foot to the 700-foot level, and drifting several hundred feet, both ways from it, on the ore. This work proved that the values have increased a little and the vein increased in width, with less schists enclosed in the quartz. The winze, which is 5 x 15 feet

* Memoir 88, Geology of Graham Island, B.C., by J. D. MacKenzie.

in the clear, has been timbered in three compartments, one manway and two hoisting compartments. A station has been cut on the 700-foot level, and pockets of 340 tons capacity cut for ore from the 700-foot stopes, which will be hoisted to storage-bins on the 550-foot or working level. The winze will be continued to the 1,000-foot level, for which work a 30-horse-power electric hoist has been installed on the 700-foot level. The ore from sinking the winze will be dumped into the 700-foot pockets.

A new ore-shoot has been opened up on the 430-foot level, showing a width of 15 feet, and 100 feet in length. The ore is a clean quartz of average values. This will be opened up to the 550-foot level by crosscuts now being driven from that level.

The upper level stopes on the 430- and 320-foot levels have been difficult to work because of the heavy bands of schists on the hanging-wall. A new system of stoping will be undertaken which will do away with the handling of this waste.

The *Pugsley* mine has been steadily developed, the tunnel now being in nearly 1,000 feet. The ore is about 2½ feet wide, with high copper content and a little gold and silver values. About another 100 feet will put the tunnel under the surface showings.

A new wash-house and dry has been built near the portal of the 550-foot level of the Surf Inlet mine, steam-heated throughout, with lockers and accommodation for 150 men. A commodious store has been built adjoining the mess-house and several new cottages are under construction. An ice-breaker has been put into commission on the lake to ensure regular shipments throughout the winter. H. J. O'Connell, mine superintendent, is the only change in the personnel of the staff.

Drum Lummon.

The Drum Lummon Copper Mines, Limited, has been operated all summer up to December. The holdings of the company, whose head office is 510 London Building, 626 Pender Street, Vancouver, B.C., consists of fifteen claims, which, I understand, have been surveyed this summer and for which application for certificate of improvements is pending. They are situated on Miskatlah bay, on the north shore of Douglas channel, about twenty-five miles east of Hartley Bay, the nearest port of call for Coast-plying boats, and from which point the property is reached by launch. There is a good floating dock on which supplies are landed by freight-boats.

The year's underground work consists of further driving on the ore, the drift now being over 200 feet long. The new drifting has exposed about the same class of ore in content and extent as was described last year. A couple of hundred tons of ore was broken down on the drift-level for milling purposes before closing down the underground work. There is a seam of fine bornite ore along one wall, but the wider portions, representing more extended replacements of the wall-rock, are low grade, being quartz, and in places pure feldspar, with bunches of bornite included in and bordering the quartz. The average of the total vein contents would be low grade, but it may be considerably increased by using some judgment in breaking down the quartz.

A new compressor with a 25-horse-power gasolene-engine for power was installed early in the spring and proved very satisfactory. A small milling plant has also been erected and had just been started the day before my visit to the property; consequently it needed considerable tuning-up before the best results could be expected. The mine-run of ore is dumped into a small bin, and from there fed into a small jaw-crusher which reduces it to about 1 inch in size, discharging into a storage-bin. Two Gibson mills, each of 18 tons rated capacity per twenty-four hours, are fed from the storage-bin, only one mill being operated while the crusher is running. The Gibson mill consists of a mortar and pestle, the pestle being given a grinding motion by the swinging of the top of it through a circle about 2 feet in diameter, and pressure is provided by a spring on the pestle, together with its own weight. The feed is ground to pass a 40-mesh screen in the mortar and is fed directly to a Wilfley type table, designed by the manufacturers of the Gibson mill. The plant is operated by a 10-horse-power gas-engine, and has demonstrated that it will produce a concentrate of 62.5 per cent. copper, 1.12 oz. gold, and 30 oz. silver from a feed of this ore of 5.9 per cent. copper. Provision will have to be made for retreatment of the middlings and treatment of the slimes, in which the loss in silver is heavy. Nevertheless, it is a very creditable little plant, and will doubtless be improved on and increased in capacity as the further development of the mine demands. With the necessary improvements suggested and a mill of adequate capacity making a good saving on suitable feed, the property should be self-supporting.

Ecstall River. The Ecstall River pyrite-showings, mentioned in last year's Report, have been further exploited by diamond-drilling by the Granby Consolidated Company during the year. No information is at hand as to the results obtained, and the work has been closed for the winter, to be resumed in the spring. The importance of the successful development of this property cannot be overestimated. It would certainly have a far-reaching effect in every way and be the making of this portion of the Coast from a mining standpoint.

I was unable to examine any of the prospects on Porcher, Gibson, and other islands during the year. There has, however, been little activity, about the only work being the yearly assessment.

On the north side of the head of Klekane inlet, J. Leedy, of Seattle, did considerable work on a group of claims situated about half a mile from the beach. The rock formation consists of a schistose-belt in which lies a vein of quartz, calcite, and altered wall-rock from 1 to 2 feet in width, carrying bornite scattered in places. The hanging-wall appears to be a band of mica-schist, the vein conforming with the strike and dip of the schists, of N. 75° W. and N. 80°. There does not seem to be much chance for the deposition of an ore-body, as the bornite only occurs in the altered wall-rock. This is the only property on the inlet on which an appreciable amount of work has been done.

There has been a little exploratory work done about half a mile from Swanson Bay on some claims owned by J. C. McNichols, of Swanson Bay, and associates. A few shots have been put in on the bank of a creek in a quartz vein lying in the schists, showing up some galena and zinc blende. Further work is necessary before any conclusions can be formed as to the width, continuity, or values of the vein.

Grand Trunk Pacific Railway Section.

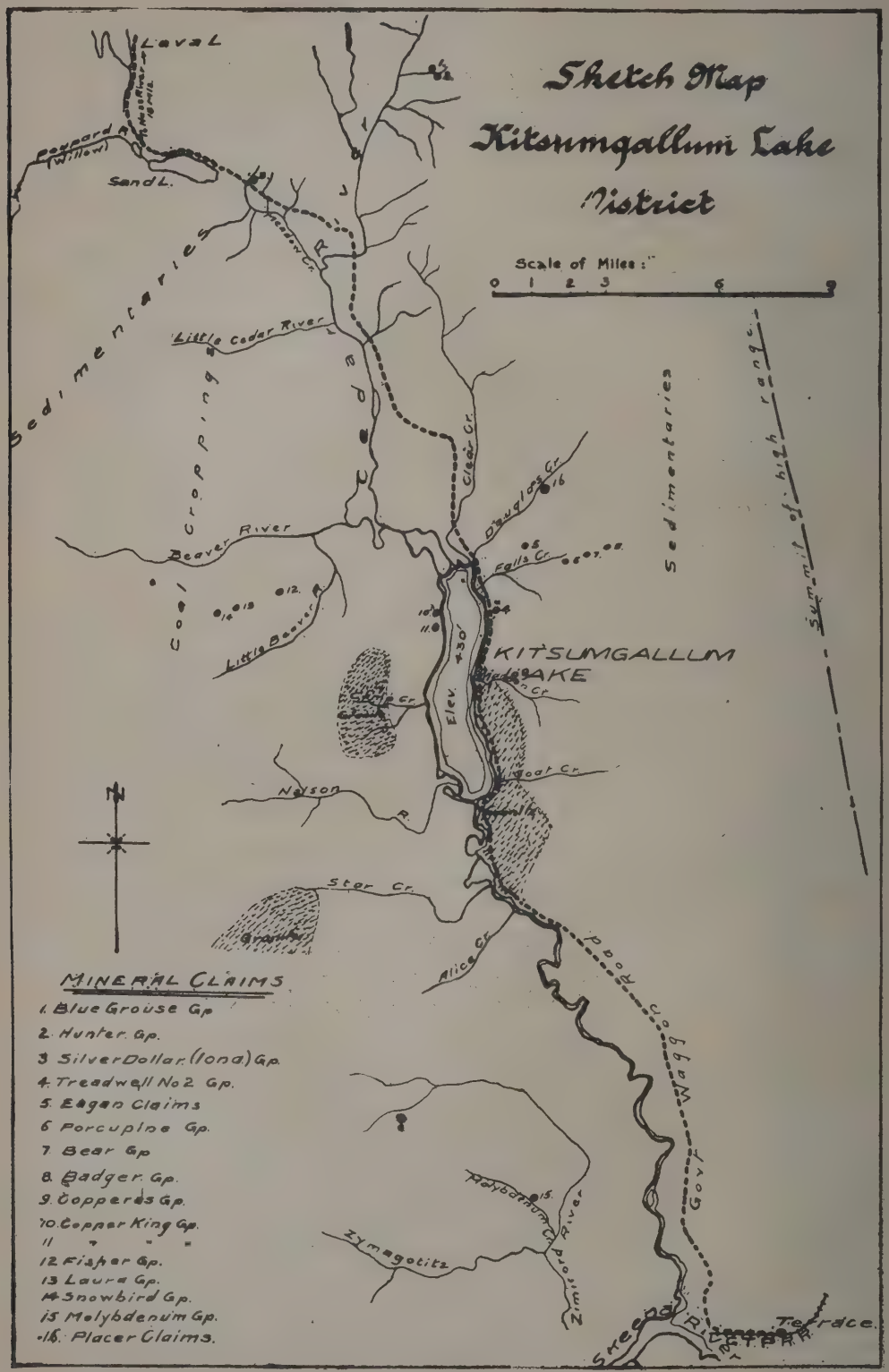
Very little mining development of any importance has taken place along the Grand Trunk Pacific between the Coast and Terrace.

Molybdenum Group. This group, consisting of three claims—*Gem*, *Star*, and *Molybdenum*—owned by T. D. Liard, Geo. W. Kerr, Prince Rupert, and J. N. Erlandsen, is situated one mile up Molybdenum creek, which flows into the Zimacord river six miles and a half up from the station of Zimacord, on the Grand Trunk Pacific Railway. There is a wagon-road built for about a mile from the station and a good trail continues through to Kitsumgallum lake. The trail to the property branches off the main trail just south of Molybdenum creek.

The showings on the claims are along the banks of the creek and very little work has been done by way of opening them up. The croppings consist of a number of small, flat, short quartz veins or lenses lying in a broad diorite dyke intruding the granodiorite. The lenses will not average over 20 feet in length, and are too far apart to be worked together and too small to be worked separately. The quartz is mineralized with pyrite, a little chalcopyrite and a little molybdenite occurring for the most part along the seams. The showing is unimportant.

Kitsumgallum Valley Section.

Kitsumgallum lake is 16½ miles from Terrace, on the Grand Trunk Pacific, and accessible by wagon-road the total distance, the upper two miles of which are not in as good condition as the balance, but can be easily put in repair when the progress of the section warrants it. The trail continues from the end of the wagon-road through to Anyox following the Dominion Government telegraph-line. This valley and the Lakelse valley on the opposite side of the Skeena river are apparently on the eastern line of contact between the Coast Range granites and the Interior sedimentaries. The general rock formation of the Kitsumgallum Lake section is sedimentary, altered in places, with here and there isolated intrusions of granite from the main mass, and should therefore be a very favourable area for prospecting. The contact-belt extends north to the Alice Arm and Stewart sections, at the heads of Observatory inlet and Portland canal respectively. This is a distance of about forty-five miles from the head of Kitsumgallum lake to Alice arm, following the Government telegraph-trail, and about an equal distance farther north to Stewart.


Sketch Map
Kitsumgallum Lake
District
Scale of Miles:
0 1 2 3 6
Laval
Sand L.
Sedimentaries
Little Cedar River
Cedar R.
Coal Cropping
Beaver River
Little Beaver
Douglas Cr.
Falls Cr.
Sedimentaries
Summit of high range
KITSUMGALLUM LAKE
Elev. 430'
Nelson R.
Ster Cr.
Granite
Alice Cr.
Skeena River
Terrace
Zymagotitz
Kaybarnum Cr.
Prov. Govt. Wagon Road
MINERAL CLAIMS
1. Blue Grouse Gp.
2. Hunter Gp.
3. Silver Dollar (Iona) Gp.
4. Treadwell No 2 Gp.
5. Eagan Claims
6. Porcupine Gp.
7. Bear Gp.
8. Badger Gp.
9. Copperds Gp.
10. Copper King Gp.
11 " " "
12. Fisher Gp.
13. Laura Gp.
14. Snowbird Gp.
15. Molybdenum Gp.
16. Placer Claims.

Copper Group.

This group is comprised of seven claims—*Copperas, Lucky Tom, Lucky Charles, Lucky Mat, Lucky Scot, Lucky Phil,* and *Lucky Bill*—and is owned by Phillip Chesley, Mat Allard, and partners. The claims are located about four miles up Maroon creek, which empties into Kitsumgallum lake on the east side about its centre.

The rock formation consists of a series of belts of mica and hornblende schists, overlain by a mass of granite about 150 feet thick. The granite intrusion is gneissoid in structure, and has many quartz veins, up to 1 foot in thickness, running through it in all directions and sparingly mineralized with chalcopyrite. Underlying the granite the schists are mineralized for a width of 30 feet with chalcopyrite disseminated throughout it, and in small veinlets lying with the bedding-planes of the schists. A sample across this belt gave a trace in gold, trace in silver, and 0.5 per cent. copper. The schists strike about east and west and dip 40 degrees to the north.

The only work done is a stripping across the showing on the side of a small creek crossing it, where a few shots have been put in, and another stripping a short distance east of this, which does not look as well on the surface. So far as can be seen, the ore is low grade, and it will take considerable work to prove whether there are richer portions which might make the whole ore body of commercial value.

Treadwell No. 2 Group.

This group consists of six claims—*Treadwell No. 2, Juneau, Alley, Yankton, Contact,* and *Pinhead Fraction,* owned by J. Belway, McLaren & Nivens, of Terrace, B.C. The property is situated about two miles from the head, on the east side, of Kitsumgallum lake.

The rock formation is of sedimentary and metamorphosed rocks north from a point just above the mouth of Maroon creek, south of which is an intrusion of granite extending for a distance of five or six miles. In the sedimentaries are beds of strata which have become shattered, allowing small veins and stringers of quartz and epidote to be deposited along the bedding-planes and cross-fractures. These thin seams of silicates carry the values in chalcopyrite, bornite mainly in the epidote, with free gold in places, the larger quartz veins, up to 12 inches in thickness, apparently being barren.

The property was under bond last year to Vancouver people, who ran a tunnel 35 feet long on a bearing of N. 40° W. across the strike of the formation, which is N. 60° E., evidently for the purpose of cutting a band of schists, carrying chalcopyrite, cropping at the edge of the lake. No values were obtained in the tunnel and the option was thrown up.

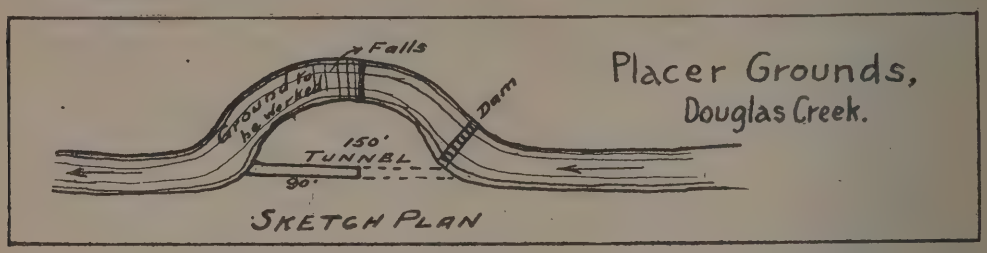
The owners have done a lot of work by way of surface stripping and open-cutting across the formation. About 100 feet south of the tunnel an open-cut shows a width of 15 feet of finely laminated chlorite-schist, and the same formation is exposed in two other cuts farther south. As this work was not extended, I presume the values are too low. About 350 feet south of the tunnel along the trail the face of the hill has been blown off for a width of 35 feet, exposing numerous veinlets and stringers of quartz and epidote with bornite, chalcopyrite, and copper carbonates lying in a slaty, micaceous, schistose formation. A grab sample was taken from the broken material from this cut, which gave only a trace each of gold, silver, and copper. A sample was also taken of the best-looking, roughly sorted ore, which gave returns of: Gold, 0.22 oz.; silver, 0.6 oz.; copper, 0.6 per cent. The rich appearance of the rock, coloured by copper carbonates, is rather deceptive. Farther south, about 1,200 feet along the lake-shore, several cuts have been made on material showing some bornite and chalcopyrite. Also, a tunnel was driven 30 feet on a red, ground-up bed of schists, in which are ribs of quartz carrying pyrite and chalcopyrite. The tunnel shows the "vein" to split near the face. A sample across 30 inches of the oxidized material, 12 feet in from the mouth of the tunnel, gave assays of: Gold, 0.04 oz.; silver, 0.1 oz.; copper, 0.5 per cent.

So far, the results obtained in average values of workable quantities of ore have not been very encouraging. However, some systematic development, such as driving on the best-looking surface showings, might disclose commercial ore.

The placer-ground on Douglas creek consists of five claims, owned by Oscar Olander, Paul Brodin, Carl Forsberg, Carl Johnson, and George Cobb. Douglas creek empties into the head of Kitsumgallum lake. The claims give a length along the creek of 1,250 feet and a width of 1,000 feet.

A tunnel was being driven by the owners at the time of my examination across a sharp bend in the creek, in order to drain the water from the creek-bed above the falls, and thus procure about 400 feet in length of dry creek-bed below the falls for working. The tunnel was in about

90 feet, with about 60 feet yet to drive. From recent information from a reliable source I learn that the tunnel was finished and some gold subsequently taken out of the creek-bed, but for some reason the owners quit it.



Blue Grouse Group. This group, about seven miles north of Cedar River crossing, which is on the Government telegraph-line, or twenty miles north of Kitsumgallum lake, on the east bank of Cedar river, consists of two claims—*Blue Grouse* and *Relief*—owned by O. Wickstrom. There is a fair wagon-road from the lake to Cedar crossing, and from there to the claims only a badly located blazed trail. A good route, however, could be selected, cutting off probably two miles of the distance and eliminating the heavy grades.

The vein is a brecciated, slaty country-rock cemented together with quartz lying in the sedimentary country-rock. The strike of the vein is N. 85° W. and the dip 50 degrees to the north, conforming with the bedding of the sedimentaries. In places in the vein the broken-up country-rock is very coarse, pieces up to 6 inches in diameter being noticed. The cementing quartz carries the mineralization of galena and chalcopyrite, the former being the more plentiful. The "vein" or stratum in the schistose formation is about 3 feet thick, with stringers of quartz penetrating into the wall-rock for 1 foot or more on each wall. There are three open-cuts along the vein, two on the *Blue Grouse* claim and one on the *Relief*. The latter is about 30 feet long, from which about 20 tons of ore has been piled up on the dump. A grab sample from this pile gave: Gold, trace; silver, 0.8 oz.; copper, 0.5 per cent. This ore could be sorted to a fair grade and, with improved transportation facilities, the property would bear investigation and further development. There is a cabin on the claims, just across the creek from the showing, at an elevation of 1,400 feet.

Hunter Group. This group is comprised of the following claims: *Hunter*, *Hemlock*, *Aurora*, *Bear Hill*, *Hunter No. 1*, and *Hunter No. 2*, which adjoin the *Relief* claim of the *Blue Grouse* group, and extend, two wide, up the hill. The group is owned by O. Olander and partners. The only work done is on the extension of the *Blue Grouse* vein, and, where exposed along the creek, does not show as wide as below, but is otherwise identical with it.

Owing to the Government bridge along the telegraph-line at Cedar crossing being washed out and the water extremely high, I was unable to get across the river. The coal-showings on the farther side would have been interesting.

Silver Coin. This group, formerly the *Iona* group, and now owned by Belway & McLaren, has had little or no work done on it since reported on in 1914 by Wm. Brewer.

Laura Group. This group, consisting of the *Laura*, *May*, and *Agnes* mineral claims, is owned by H. Conroy, J. Couture, and O. Gendron, of Terrace, B.C. The claims are situated on the hill between the Little Beaver and Big Beaver rivers, about six miles from the lake. I was unable to examine them on account of the snow, but I understand that a 20-foot shaft has been sunk on a showing of arsenopyrite, running, it is said, $16 a ton in gold.

There are several claims and groups on the west side of the lake on which a little work has been done; the majority of them, however, are high up and were covered with snow at the time of my trip through this section.

LAKELSE VALLEY (THORNHILL MOUNTAIN) SECTION.

Ptarmigan Group. This group includes the following mineral claims: *Ptarmigan* and *Sadie*, owned by J. A. Michaud; the *St. Paul*, owned by Albert Michaud; and the *Marie*, owned by Bert Michaud. The claims are located on the summit of and down the east side of Thornhill mountain. The showing, which consists

of a decomposed belt of schists in which are bands and seams of quartz running with the formation, is mineralized with grey-copper (tetrahedrite), chalcopyrite, and galena for a width of 8 feet. This mineralized vein or belt lies in a wider zone of sedimentary rocks, apparently about 50 feet wide. About the only work done is an open-cut, at 4,450 feet elevation, showing a face about 12 feet high of very badly oxidized material. A sample across the 8 feet gave assay returns of: Gold, trace; silver, 4.4 oz.; copper, trace. The vein strikes at N. 70° E. and stands almost perpendicularly. The country-rock is apparently an enclosed, altered band of sedimentaries in the granite. It is a good strong showing and should have sufficient depth obtained on it to get below the surface oxidation. There is a fairly good trail leading to all the claims on Thornhill mountain, branching from the Lakelse wagon-road.

On the *St. Paul* claim of the group is a big vein of quartz averaging about 12 to 14 feet in width. It has been stripped and open-cut in several places, showing a very well-defined and, in places, well-mineralized vein striking N. 80° E. and dipping 35 degrees to the north. The minerals are pyrite, chalcopyrite, galena, and zinc-blende. Samples of the best pyrite have assayed up to $80 a ton in gold, while samples of the mixed minerals assay up to $60 a ton in all values. The showings on this vein are at an elevation of 4,530 feet.

The same belt and mineralization extend down the hill on the east side to the *A*, *B*, *C*, *D*, group, owned by George Little and associates, of Terrace, B.C. No work had been done on this group at the time of my examination.

Society Girl Group.

This group, consisting of the *Society Girl*, *Silver Bell*, and *Don* mineral claims, owned by Dan Mason and W. Bell, adjoins the *St. Paul* claim of the *Ptarmigan* group on the west, and contains the continuation of the big quartz vein described on that claim. It has been traced for over 1,000 feet on the *Society Girl* claim and shown to range from 1 to 15 feet in width. Free gold has been panned from it in different places. Several smaller quartz veins have been prospected and opened up at intervals, but have proven rather low grade.

An open-cut was being run in on a soft schistose-belt of oxidized material about 6 feet wide. The only mineral to be seen was specks of hæmatite. A sample across the face failed to show any values other than a trace each of gold and silver. It strikes N. 30° E. and would therefore intersect the big quartz vein at an angle of 45 degrees.

A shaft has been sunk on a feldspar vein, showing both orthoclase and plagioclase varieties, mineralized with a little hæmatite, but carrying no values.

The big quartz vein is well worth extensive development on this property, as considerable depth can be obtained to drive in under the *St. Paul* claim.

Lucky Seven Group.

This group is situated on the south-west slope of Thornhill mountain. There are five claims in the group, as follows: *Lucky Seven*, owned by A. Oleson; *Beaver*, owned by W. Dohl; and the *Diamond*, *Ruby*, and *Pedro*, jointly owned by Oleson & Dohl. These partners have owned these claims for several years, and certainly deserve credit for the exceptional amount of intelligent prospecting and exploration work which they have done.

On the *Diamond* claim they have opened up a small quartz vein lying in a quartz diorite dyke. This vein where crossing a small creek shows a fault-throw of about 25 feet horizontally and about 8 feet vertically. It lies very flat, dipping about 20 degrees west, and has a strike of north-east. The overlying diorite has been stripped off it for about 8 feet square, from which area of vein two or three small pockets of free gold yielded $300 by mortaring and panning. The gold appears to assemble at points in the vein where small stringers of quartz join it from the country-rock. One patch of gold left in-place showed about 6 inches in diameter of solid gold in the quartz, and lying on the quartz were about 2 inches of iron oxide full of free gold. Associated with the free gold are sulphides of silver, mainly stephanite. I am reliably informed that the owners, in further opening up this vein, took out $4,000 in free gold in two weeks during the past summer. The elevation of this showing is 3,700 feet.

Farther down the creek, still on the *Diamond* claim, a crosscut tunnel has been driven 15 feet to a small quartz vein showing on the surface and a drift for 20 feet on the vein. The quartz is about 6 inches wide where struck by the crosscut, but pinches in the face to a soft mud-filled fissure. The quartz, decomposed and rusty, carries some galena and a little chalcopyrite and pyrite. A sample from a small pile of the best of it at the mouth of the tunnel gave assays of: Gold, trace; silver, 4 oz.; and copper, trace. The vein strikes N. 30° E. The tunnel is at an elevation of 3,350 feet.

Still lower on the same creek, at an elevation of 3,250 feet, another tunnel has been driven 18 feet on the same vein, showing galena with considerable grey-copper for a width of about 8 inches in the face. Brewer's sample of this gave 107 oz. in silver. Samples from here of the purer grey-copper ran as high as 490 oz. in silver to the ton.

On the same claim, about 250 feet south of the above-mentioned vein, is a parallel one with the same strike and a dip of 53 degrees to the north-west. The quartz carries galena, chalcopyrite, pyrite, and a trace of tetrahedrite (grey-copper), and follows a light-coloured acidic dyke which is traceable on the surface for several hundred feet along the creek. A sample of the best ore assayed: Gold, $2.40; silver, 60 oz. to the ton; lead, 25 per cent.

On the *Beaver* claim, along the first creek west of the camp, a strong, well-defined quartz vein of from 2 to 4 feet in width is exposed for a length of 500 feet by seven open-cuts. The creek swings away from the upper end of the vein, and consequently it has not been traced beyond that point because of the very heavy overburden. It strikes N. 30° E., but apparently dips in an opposite direction to the other veins on the property, at an angle of 35 degrees to the south. I had not the time to properly sample the vein, but was informed by the owners that their results, from carefully taken average samples from all the cuts, gave an average value of $10 a ton, of which $7.50 was gold and the balance in lead, copper, and silver. The gold is free and would therefore be recovered by amalgamation, while the metals could be tabled or floated. There is plenty of timber for all purposes and water for milling and power could be obtained from the creek running over the vein or increased from other creeks a few hundred feet away.

In my judgment, this vein will warrant investigation for a small plant, keeping in view the fact that considerable ore can be obtained for milling from the numerous other veins scattered over the property.

Iron Hat.

This claim, owned by A. Oleson, Terrace, B.C., is situated about 700 feet up the west slope of Thornhill mountain from the Lakelse wagon-road at an elevation of 1,150 feet. The rock formation consists of a band of sedimentaries enclosed in the granodiorite. In this lies a quartz vein, varying in width from a few inches up to 4 feet, striking N. 20° E. and dipping east at 80 degrees. It has been exposed in three or four open-cuts on the surface for probably 200 feet above the tunnel. These cuts show quartz containing pyrite and chalcopyrite and in places 6 inches of solid pyrite. A sample of the straight pyrite assayed: Gold, 2.36 oz.; silver, 2 oz. a ton. This when roasted will pan native gold freely. A sample of the quartz containing a little chalcopyrite assayed only a trace each of gold and silver.

A tunnel has been driven for 60 feet towards these open-cuts, starting on a small stringer of quartz which has now improved in the face to quartz stringers to the width of 2 feet. It is estimated that a further distance of 20 feet will put the face of the tunnel under the croppings. This is a good, well-situated small showing, and there is reason to expect that it will produce profitable ore.

E, F, G, H Group.

This group of four claims is owned by a Terrace syndicate. The claims are situated west of and adjoining the *Lucky Seven* group. The showing consists of a small, up to 2 feet in width, flat quartz vein exposed along the face of a granite bluff. The quartz is mineralized, in oxidized seams, with small amounts of chalcopyrite carrying a little gold and silver values. The granite along the vein is in places altered to nearly straight quartz, while in other places it is nearly pure hornblende and epidote, in which are traces of chalcopyrite. The vein appears to strike about N. 60° E. and to dip 20 degrees to the west, corresponding closely with the free-gold vein on the *Diamond* claim of the *Lucky Seven* group.

A crosscut of 73 feet in length was run from the surface to the vein and a drift of 17 feet on the vein, in which no values were obtained; consequently the work was stopped. The tunnel is at an elevation of 3,350 feet, or 350 feet below the showing on the *Diamond* claim. The finding of gold values in such a vein is purely a gamble. It would have been much better work to have started the tunnel on the vein and drifted the total 90 feet instead of doing 73 feet of dead-work.

Dardanelles Group.

This group consists of four mineral claims—*Trail*, *Trail Fraction*, *Dardanelles*, and *Independent*—owned by George W. Kerr, J. Crocker, and J. Carmichael, of Prince Rupert, B.C. The claims are situated on the north bank of the Zymoetz (Copper) river, fourteen miles from Copper City and eighteen miles

from Terrace. The Skeena river is crossed by ferry from Terrace, either at Terrace or above at Copper City, the one at Terrace being the larger and most generally used. From Copper City there is a fine horse-trail all the way up the Zymoetz river, the first four miles being on the south side and the balance on the north side of the river. The upper end has a great deal of downed timber over it, and in places the undergrowth has almost closed it in, but the whole trail could be put in good repair with the expenditure of a few hundred dollars.

There are three quartz veins on the property, all with the same strike of N. 40° E. and dip of 52 degrees to the north, and traceable on the surface for at least two claim-lengths. The surface has all been burnt over, except down along the Zymoetz river and in the creek-gulches, and the overburden is not very heavy; consequently it is not difficult to trace the veins on the surface.

The North or No. 1 vein and No. 2 vein are about 16 feet apart, separated by a dyke of quartz porphyry, while No. 3 vein lies about 180 feet south of No. 2. The general rock formation is a massive granite. The walls along the veins are a greenish-coloured altered granite for a foot or more from the vein.

No. 1 vein has a short tunnel of about 30 feet in length driven on it, showing the vein to average about 18 inches in width and to be well mineralized with pyrite, chalcopyrite, and a little galena. It is at an elevation of 600 feet, or about 50 feet above the Zymoetz river. At 800 feet elevation this vein is again exposed by an open-cut and a short tunnel of 10 feet. This work shows a movement of the walls and the pinching of the vein to a seam of ground-up rock. Farther up the hill, at an elevation of 1,100 feet, a shaft has been sunk to a depth of 12 feet on this vein, showing it to be 6 feet wide of banded quartz, about half of which is fairly well mineralized with pyrite and galena, the remaining half being straight quartz. Some free gold is said to have been found in this shaft.

The No. 2 vein has only been opened up at 800 feet elevation. Here an open trench has been dug for 30 feet along the vein and a shaft 8 feet deep sunk at the face, giving a total face of 20 feet, which shows the vein and walls to be well defined. A pile of ore has been sorted on the dump from the open-cut, and the 20-foot face shows about 4 feet of well-mineralized vein. A sample taken across the bottom of the shaft 4 feet in width gave assay returns of: Gold, $5.60; silver, 1.8 oz.; copper, 1.8 per cent. I should judge that this ore would have a ratio of concentration of 6 or 7 into 1.

The No. 3 vein had only been stripped in one place when I examined the property, showing a width of about 6 feet. A few shots were put in later on, and, I understand, exposed about the same mineralization as in the shaft on No. 2 vein.

There are three creeks on the property which could be developed into a splendid water-power. Timber could be obtained from along the Zymoetz river and the creek-gulches where it was not affected by the fire.

I consider this a very promising property and one which has all the ear-marks of developing a big tonnage of a good grade of milling-ore.

Snowflake Group. This group situated at the head of the Kitniakwa river, a branch of the Zymoetz river, flowing into it at twenty-eight miles up from the mouth.

There are two claims in the group—*Snowflake* and *Kitwan*—owned by John Gaberil, of Copper City, B.C. They are reached from 28-Mile by a trail, four miles to his first cabin and eight miles from there to the claims, very poorly blazed and hard to follow.

The country-rock up the Kitniakwa, where not granite, is a reddish mottled rock, probably an andesitic porphyry. The showing on the property is a small, lenticular body of altered and crushed dyke-rock, along the seams of which have been deposited some hæmatite, possibly small amounts of chalcocite, with an occasional flake of native silver. There is little work done on the showing, but it appeared to be not more than a foot or two wide, although the rock is copper-stained for a greater width. The porphyryitic dyke along which the ore lies crosses the creek, but no ore can be seen at that point. I therefore think that the mineralization is a small, local enrichment on the surface. A small sample showing flakes of native silver on the seam-faces was assayed and gave 7.5 per cent. copper and 19 oz. silver to the ton. The showing, with the present condition of transportation, is not important. The surrounding country from a prospecting standpoint justifies the construction of a good, slashed-out trail from the Zymoetz River trail.

N.P. Iron Mines.

The North Pacific Iron Mines, Limited, is a company incorporated under the laws of British Columbia, with its registered office at Prince Rupert, B.C. The property of the company comprises some 375 acres of mineral claims, situated thirty-nine miles from Copper City, east of Terrace, which is just across the Skeena river from the Grand Trunk Pacific Railway. A preliminary survey of the Grand Trunk Pacific crosses the property about six miles west of the summit which is at the head of Zymoetz river.

The ore-deposits, classed as limonite, lie on a rugged side-hill and may be expected to have filled all the depressions, as well as being deposited on the flat benches. One open showing extending down the hill has a pitch of about 30 degrees, and is about 100 feet wide by about 600 feet long. An open trench has been dug about the centre of this deposit, giving a depth of 22 feet of ore. The whole area over which the iron is deposited would probably be about 1,000 feet wide at the upper border of it, and about 2,000 feet wide at the base of the hill. Outside of the open showing just mentioned the area is heavily timbered, with a large portion of it swampy ground which one has every reason to suppose will be a heavy deposit of iron. Numerous cuts have been put into the ore from the side-hill, but a great deal of drilling would be required to test the ground in order to make an estimate of the tonnage, which has been variously estimated at from 1,000,000 to 7,000,000 tons. A reasonable estimate now would be about 3,500,000 tons. The area could be sufficiently drilled with an Empire hand-drill or a light churn-drill, to get a fairly accurate idea of the tonnage, for $3,000 or $3,500.

The average content of the ore taken from assays of many samples would probably be about as follows: Iron, 53 per cent.; phosphorus, 0.3 per cent.; sulphur, 1.75 per cent.; silica, 1.5 per cent.

The ground is well suited for mining in benches by steam-shovelling, drag-line, or other economical method. The serious handicap is, of course, the transportation, requiring the construction of a railway for a distance of at least forty miles to the Grand Trunk Pacific and a further haul of ninety miles to tide-water at Prince Rupert. Any power required for such purposes could be developed in the Zymoetz river. The development of showings of other minerals in that section might furnish a considerable tonnage for a railway. This class of ore has been proven to make a good smelting mixture with the magnetite ores, so abundant on the Coast and islands, and which has been under investigation during the past year.

NASS RIVER MINING DIVISION.

This Division was created on September 1st, 1918, and has the distinction, due to the production of the Granby Consolidated Mining, Smelting, and Power Company, Limited, of being the largest mineral-producing Division in the Province. For the purposes of this report it will be subdivided as follows: Nass River Division—Observatory Inlet Section; Alice Arm Section; Kitsault River Section; Illiance River Section.

Observatory Inlet Section.

The Granby Consolidated Mining, Smelting, and Power Company, Limited, operating its *Hidden Creek* mines and smelting plant at Anyox, has smelted 857,871 tons of ore, exclusive of limestone and quartz used for fluxing purposes, producing 29,692,376 lb. copper, approximately 6,000 oz. of gold, and 382,000 oz. of silver.

An excellent report on the company's holdings, plant, and operations, quoted from articles written by W. A. Williams, superintendent of smelters, was contained in last year's Minister of Mines' Report, and therefore need not be gone into.

The 100-ton "pilot" mill has been operating continuously all year in experimental concentration-work on the company's different *Hidden Creek* ores, as well as ores from their Alaska properties. The tests have been confined to the flotation process, for the reason that the finely disseminated copper content of the ore necessitates fine grinding to liberate it. The mill is equipped with crushing machinery, consisting of a jaw-crusher and ball-mills, and two series of Janney flotation-cells, which have proven fairly successful. Small tests have been made, with very satisfactory results, with a differently designed machine, and radical changes are therefore being made in the mill. The concentration of the siliceous *Hidden Creek* ores has been worked out very successfully, and encouraging results are being obtained from experiments in the selective flotation of the heavy sulphide ores.

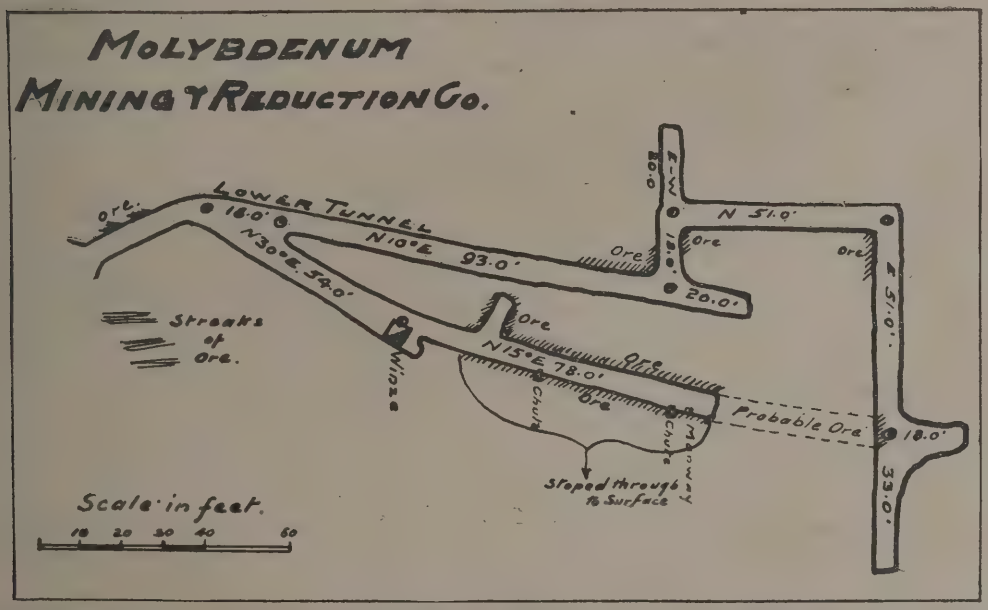
The company has under way an important undertaking in the installation of coke-ovens, with accessories for saving and utilizing the by-products. The coal-supply for this plant will be furnished from the company's own coal-mines on Vancouver island. The coke plant will cost approximately $2,000,000, and it is expected it will be in operation early in the spring.

The most important prospecting-work on new properties has been the diamond-drilling of the big pyrite-showing on the Ecstall river. I understand that results to date have been sufficiently encouraging to justify the continuation of work next spring.

The company employs about thirty men the year round at Swamp point, on Portland canal, mining limestone used for fluxing purposes at the Anyox smelter; the production is about 250 tons a day. Fluxing quartz is mined on the point just opposite Anyox and also at the Macey quartz camp on Alice arm.

Alice Arm Section.*

The only property on Alice arm that I visited was that of the Molybdenum Mining and Reduction Company. This property was fully described in J. Turnbull's report in the Minister of Mines' Report of 1916, page 66. It has been inactive ever since and I will therefore omit



going into details. I was rather favourably impressed with the ore possibilities, and it is to be regretted that the property should lie idle while the demand for molybdenum was so urgent. (*See* sketch of workings.)

Kitsault River Section.

This portion of the Nass River Mining Division has had a very active summer, due to railway-construction by the Dolly Varden Mines Company, which has built from tide-water to the property, a distance of nineteen miles. The winter had been looked forward to as the starting of the *Dolly Varden* mine as a regular shipper, which would mean that the spring would see renewed activity and life in the mining industry. However, the contracting company building the railway went into liquidation, resulting in the tying-up of everything for the winter. Unless the railway affairs can be adjusted, allowing the resumption of operations in the spring, it will handicap this section for another year.

From a mining standpoint this whole section gives every promise of coming very prominently to the front, for rarely are there seen so many encouraging showings in one section as are being proven in this.

* Turnbull's report, Minister of Mines' Report, 1916.

The large amount of prospecting and development work done by the individual owners on their respective claims is a very noticeable feature of this section, and will result in a very rapid progress when transportation facilities are provided.

A very favourable factor in connection with the ores of this section is that they are particularly well adapted for fluxing purposes for the Granby smelter; consequently, lower-grade ores will be profitable because of only local freight rates instead of a long haul to southern smelters, and probably a more favourable treatment rate.

Starting at the beach, the following properties were examined during the past season. I may add that in the majority of cases I have done little or no sampling, for the reason that to sample these properties in such a way that the samples would be reliable and serve the purpose for which sampling should be done, I could have put in the whole season in this one section. My description, therefore, of a property is to endeavour to give the general reader a good, clear idea of the nature and extent of the showings, and to convey to the mining man sufficient information that he may decide whether the property is worth his investigation or not.

Black Bear Group.

This group of three claims—*I Chance It*, *Aldebaran*, and *Black Bear*—formerly the old *Roundy* property, is now owned by Salinas Bros. *et al.* The owners shipped 13 tons of ore during the year, giving gross returns of $2,712 in silver.

Independent Group.

This group consists of three claims—*Independent No. 2*, *Independent No. 3*, and *Independent No. 4*—and is owned by D. A. McPhail, of Alice Arm. The claims are located just above the townsite of Alice Arm, about 1,500 feet from the post-office, and therefore are practically on tide-water. There was a fair trail from the railroad to the cabin, which is at an elevation of 600 feet, which has been improved by the present bondholder who has been working on the property for the past two or three months.

The showing is a quartz-slate vein from 1 to 6 feet in width lying in a slate formation and grading from almost pure quartz in places to a brecciated slate cemented with quartz and a little calcite. It is an exceptionally well-defined vein, with two clean walls, running due north and south and with a dip to the west of 65 degrees. There is a small basic dyke lying on the foot-wall which is in evidence wherever the vein is exposed. The quartz carries pyrite, galena, chalcopyrite, and some blende.

The work done at the time of my examination before the present bonder had started consisted of a tunnel, a shaft, and some surface stripping. The tunnel, at an elevation of 650 feet, had been driven 50 feet on the vein, showing it to have a uniform width of about 1 foot and composed of broken-up wall-rock with quartz-filling, the slate predominating. The quartz is slightly mineralized and the whole is of low values. Above the tunnel, at an elevation of 700 feet and probably 250 feet from the mouth, a shaft has been sunk to a depth of 14 feet on the vein between two fine walls 6 feet apart. The filling between the walls is about half of quartz and slate, with quartz predominating, and the hanging-wall half of slate and quartz, the quartz being in stringers throughout the slate. At the bottom of the shaft the vein is mostly quartz occupying 5 feet of the filling, the other foot being slate. The vein has been stripped about 50 feet beyond the shaft, showing it to be practically the same as the top of the shaft. A sample was taken from a narrow mineralized seam on the foot-wall at this open-cut, giving: Gold, trace; silver, 20.5 oz. a ton; lead, 1 per cent; zinc, 7.2 per cent.

This property is ideally located, and with such a well-defined vein, carrying fair values in places, it is well worth considerable development. A comparatively low-grade ore would be profitable because of its advantageous situation for mining and transportation.

La Rose Group.

This group (*see* Reports of 1916 and 1917), consisting of two claims—*La Rose* and *La Rose No. 1*—is owned by Miles Donald *et al.*, of Alice Arm. The property was worked this summer by the owners, who sorted, sacked, and shipped 11 tons of ore, which assayed 153.5 oz. a ton in silver, a total of 1,690 oz. About 12 tons more is ready for shipment, which it is estimated will assay about 500 oz. a ton in silver. The most of this ore was obtained from the north end of the open-cut and from a shaft sunk on the ore in the open-cut. The owners, assisted by the Mines Department, built a first-class trail from the railroad to the property, a distance of two miles. It is on an even grade, climbing 1,850 feet from the railroad, which is 200 feet elevation here, to the tunnel, and puts the property in good shape to maintain small shipments of high-grade ore. It looks as if the vein might be

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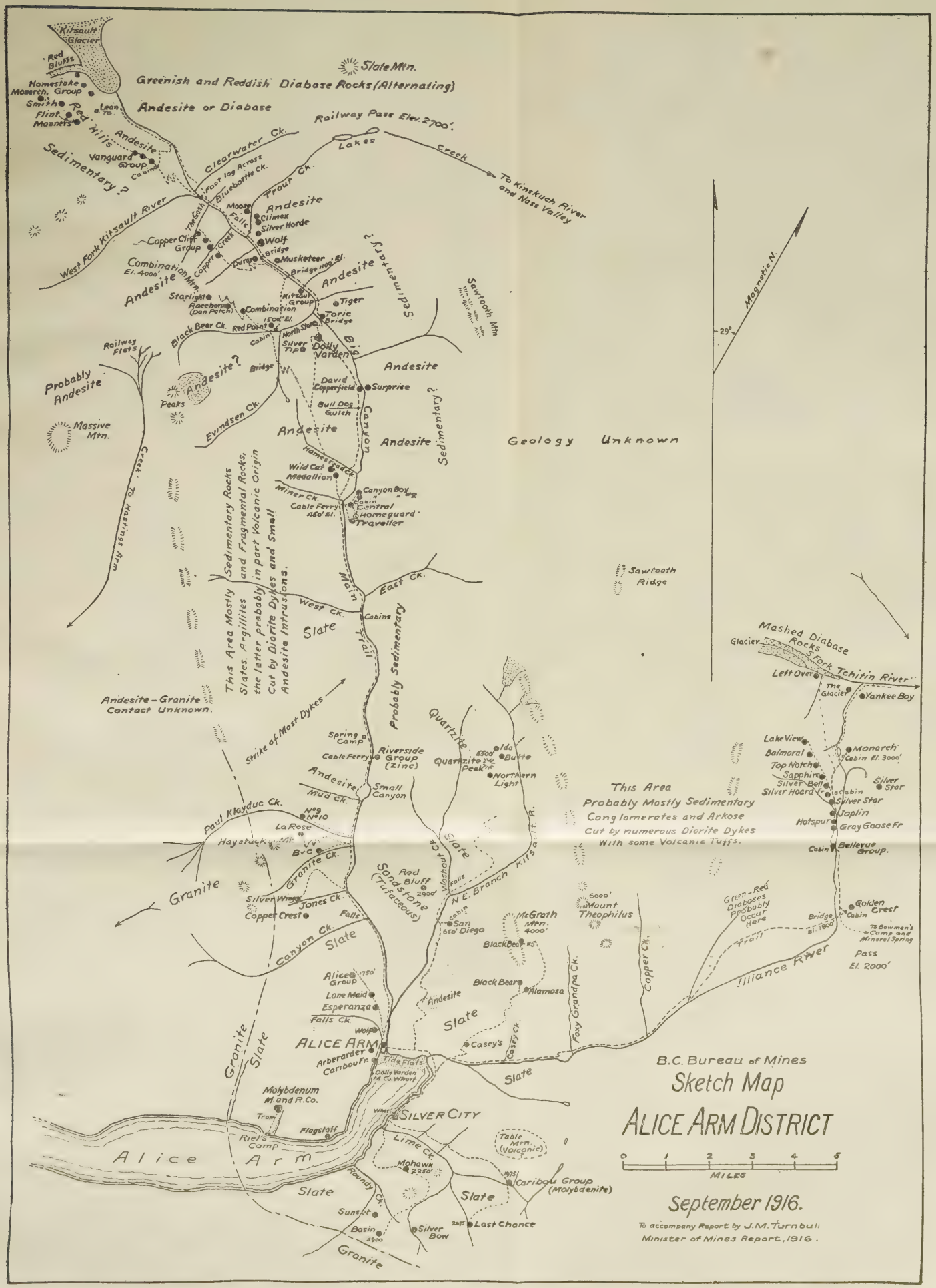

Kitsault Glacier
Red Bluffs
Homestake Moserch. Group
Smith
Red Flint
Manners
Lean-to
Red Hills Andesite
Vanguard Group
Cabins
Sedimentary?
Slate Mtn.
Greenish and Reddish Diabase Rocks (Alternating)
Andesite or Diabase
Railway Pass Elev. 2700'
Lakes
Creek
To Kinskuch River and Nass Valley
Clearwater Ck.
Log Across
Bluebottle Ck.
Trout Ck.
West Fork Kitsault River
The Gash
Moose Falls
Andesite
Climax
Silver Horde
Wolf
Bridge
Copper Clip Group
Copper Creek
Dump
Musketeer
Bridge
Combination Mtn.
El. 4000'
Andesite
Sedimentary?
Starlight
Racehorse (Dan Patch)
Combination
1500' El.
Kitsault Group
Tiger
Toric
Bridge
Sawtooth Mtn
Black Bear Ck.
Red Point
Cabin
North Star
Silver Tip
Dolly Varden
Big
Railway Flats
Probably Andesite
Andesite?
Bridge
Andesite
David Copperfield
Surprise
Peaks
Bull Dog Gulch
Evindsen Ck.
Canyon
Massive Mtn.
Andesite
Andesite
Sedimentary?
Geology Unknown
Magnetic N.
29°
Homestead Ck.
Wild Cat
Medallion
Canyon Boy
Cabin
Miner Ck.
Cable Ferry
450' El.
Control
Homeguard
Traveller
Creek to Hastings Arm
Sedimentary Rocks and Fragmental Rocks, in part Volcanic Origin
Slates, Argillites the latter probably Cut by Diorite Dykes and Small Andesite Intrusions.
Main
East Ck.
West Ck.
Cabins
Slate
Trail
Sawtooth Ridge
Mashed Diabase Rocks
Glacier
S. Fork Tchitin River
Left Over
The Glacier
Yankee Boy
Andesite-Granite Contact Unknown.
Strike of Most Dykes
Probably Sedimentary
Quartzite
Spring Camp
Cable Ferry
Riverside Group (zinc)
Quartzite Peak
6500'
Ida
Butte
Northern Light
Andesite
Small Canyon
Mud Ck.
Paul Klayduc Ck.
No 9
No 10
La Rose
Haystack Mt.
Br C
Granite Ck.
Granite
Silver Wings
Jones Ck.
Copper Crest
Falls
Canyon Ck.
Slate
Red Sandstone (Cretaceous)
Red Bluff
2900'
Washout
Falls
N.E. Branch Kitsault R.
Slate
Lake View
Balmoral
Top Notch
Sapphire
Silver Bell
Silver Hoard Fr
Monarch
Cabin El. 3000'
Silver Star
Cabin
Silver Star
Joplin
Hotspur
Gray Goose Fr
Cabin
Bellevue Group.
This Area Probably Mostly Sedimentary Conglomerates and Arkose Cut by numerous Diorite Dykes With some Volcanic Tuffs.
Green-Red Diabases Probably Occur Here
Golden Crest
Cabin
Bridge
El. 1900
To Bowman's Camp and Mineral Spring
Trail
Pass
El. 2000'
Illiance River
Cabin
San Diego
650'
McGrath Mtn. 4000'
6000'
Mount Theophilus
Copper Ck.
Black Bear #5
Black Bear
Alamosa
Andesite
Slate
Foxy Grandpa Ck.
Casey Ck.
Casey's
Alice Group
1750'
Lone Maid
Esperanza
Falls Ck.
Wolfe
ALICE ARM
Arberarder
Caribou Fr.
Tide Flats
Dolly Varden M. Co. Wharf
Granite
Slate
Molybdenum M. and R. Co.
Tram
Wharf
SILVER CITY
Flagstaff
Riel's Camp
Alice Arm
Table Mtn. (volcanic)
Lime Ck.
Mohawk 2250'
Caribou Group (Molybdenite)
Roundy Ck.
Slate
Slate
Sunset
Basin 3900
Silver Bow
2675
Last Chance
Granite
B.C. Bureau of Mines
Sketch Map
ALICE ARM DISTRICT
0 1 2 3 4 5
MILES
September 1916.
To accompany Report by J.M. Turnbull
Minister of Mines Report, 1916.

picked up farther north from the tunnel, down the hill towards Paul Kladuc creek. Other ore-shoots than the one from which the ore is now being taken may be reasonably expected in the vein.

Three men were employed sorting and sacking and six pack-horses on the trail packing the ore from the tunnel to the railway. Some very fine specimens of native silver, argentite, and grey-copper were found in the ore on the dump.

There are a number of small properties similar to this, situated within easy distance of the railway, which will probably become small shippers when railway transportation is completed.

Cape Nome Group.

This group of three claims—*Nome*, *Rambler*, and *Eldorado*—is owned by Sid Miller, of Alice Arm. A tunnel is being driven on a 6-foot banded slate and quartz vein lying in an altered limestone formation. The strike of the vein is north-west, with a dip of 50 degrees to the north. The only mineral showing yet is pyrite, carrying no values. A little zinc has been found on the surface farther up the hill. The tunnel is on an even grade with the railroad, which is only a few hundred feet from it.

Dolly Varden.

The Dolly Varden Mines Company* owns the eight Crown-granted claims comprising the *Dolly Varden* group, and also the *Wolf* group of four claims—*Wolf*, *Wolf No. 2*, *Wolf No. 3*, and *Wolverine*. The *Dolly Varden* is situated on the west bank of the Kitsault river, nineteen miles from Alice Arm, and the *Wolf* group about two miles farther up the river, on its east bank.

There has been comparatively little work done on either properties for the past two years, the company devoting all its attention to the building of the railroad from the beach to the mine.

The *Dolly Varden* has been developed by underground work and diamond-drilling to such an extent that there are thousands of tons of shipping-ore in sight and many thousands of tons of milling-ore available. It is therefore only a matter of transportation when this property will take its place with the producing mines, and will continue to expand, with the installation of mining, milling, and power plants, into one of the important mines of the Province.

The *Wolf* group was staked by Don Cameron in 1916 and held only a couple of months before selling to the Dolly Varden Company for $50,000. A great deal of prospecting-work has been done, principally by diamond-drilling, of which there is about 5,000 feet, proving the existence of a big body of milling-grade ore. At an elevation of 1,325 feet, or 200 feet above the river, a tunnel was started on and driven in the ore-body for 35 feet, a cross-cut then run 10 feet toward the foot-wall, and another 50 feet toward the hanging-wall, or a total of 60 feet across the vein, without encountering either wall. The vein, striking N. 70° E. and dipping 72 degrees to the north-west, is a pyritized quartz containing argentite and ruby-silver, lying in the andesite "silver-belt."

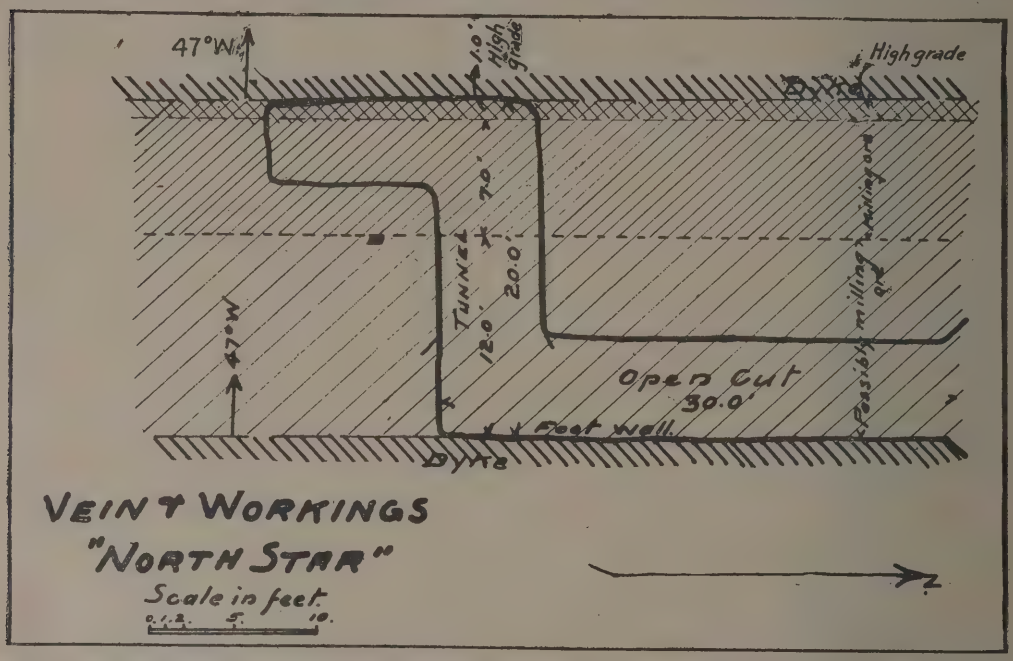
The company plans extending the railway through to the *Wolf* property and erecting a concentrator convenient to both mines. Flotation tests have been made on these ores with very satisfactory results.

North Star.

This claim is owned by Gus Pearson, Ole Evindsen, and E. Carlson, of Alice Arm, B.C. It is situated north-west of and adjoining the *Dolly Varden* claims. At an elevation of 1,600 feet, or about 700 feet above the railroad, the showing has been opened up by an open-cut 30 feet long, following along a basic dyke on the foot-wall, then a crosscut of 20 feet to the hanging-wall and a drift of 20 feet on the hanging-wall portion of the vein. (*See* sketch.) This work exposes the vein for its full width of 20 feet between the dykes which apparently form the walls, although ore has been found in breaking through the foot-wall dyke. The enclosing country-rock is andesite, locally termed the "silver-belt," since all the silver-showings in the section occur in it. The vein-filling is a pyritized siliceous rock, probably the altered and silicified country-rock. About 8 feet in width on the hanging-wall of the vein is almost pure quartz and carries the principal values, though there are small bunches of ore occurring in the remaining 12 feet or less siliceous portion of the vein-filling. The quartz is mineralized with pyrite and carries the values in silver, occurring as argentite, ruby-silver, and a little galena, and will average from 20 to 25 oz. a ton. There is about a foot of high-grade ore on the hanging-wall which will assay over 100 oz. a ton, with bunches of very high grade in it. A sample taken from the last round out of the face gave: Lead, trace; silver,

* *See* Minister of Mines' Reports for 1916 and 1917.

20 oz. a ton. About 100 tons has been more or less sorted and piled on the dump, which the owners claim will average better than 40 oz. in silver to the ton. There are several cuts below the tunnel, proving the continuity of the vein to the lower boundary-line of the claim. The present tunnel-level will gain a depth of about 100 feet on the vein when it is continued through to the *Dolly Varden* line. A further depth of probably 150 feet can be obtained to the lower



end line of the claim, beyond which either tunnelling from the claim below, owned by others, or sinking will have to be resorted to. A length of 600 feet of vein is contained in the claim, which, with the possible depths just mentioned, shows the tonnage possibilities. Further exploration may prove a tonnage of medium-grade shipping-ore sortable to a high grade, or it may prove the whole to be of milling grade; the chances are good for either.

The property, having the advantage of cheap shipping facilities, has a very favourable outlook.

Toric Group. This group is comprised of four claims—*Toric*, *Anglo*, *Moose*, and *Lamb*. The claims are owned by Strombeck Bros. and are situated on the east side of the Kitsault river, about opposite the *North Star* claim. They extend from the river's edge up the hill, and as the railroad-grade runs across the *Toric* claim the property is well located for transportation. There is a good cabin on the *Toric* claim just above the railroad-grade which has been cut along here, crossing to this side of the river about half a mile above the *Dolly Varden* sawmill. With a reasonable freight and treatment rate, a $10 a ton ore would about break even; consequently any property within a short distance of the railway will be able to handle a comparatively low-grade ore without even hand-sorting or concentration.

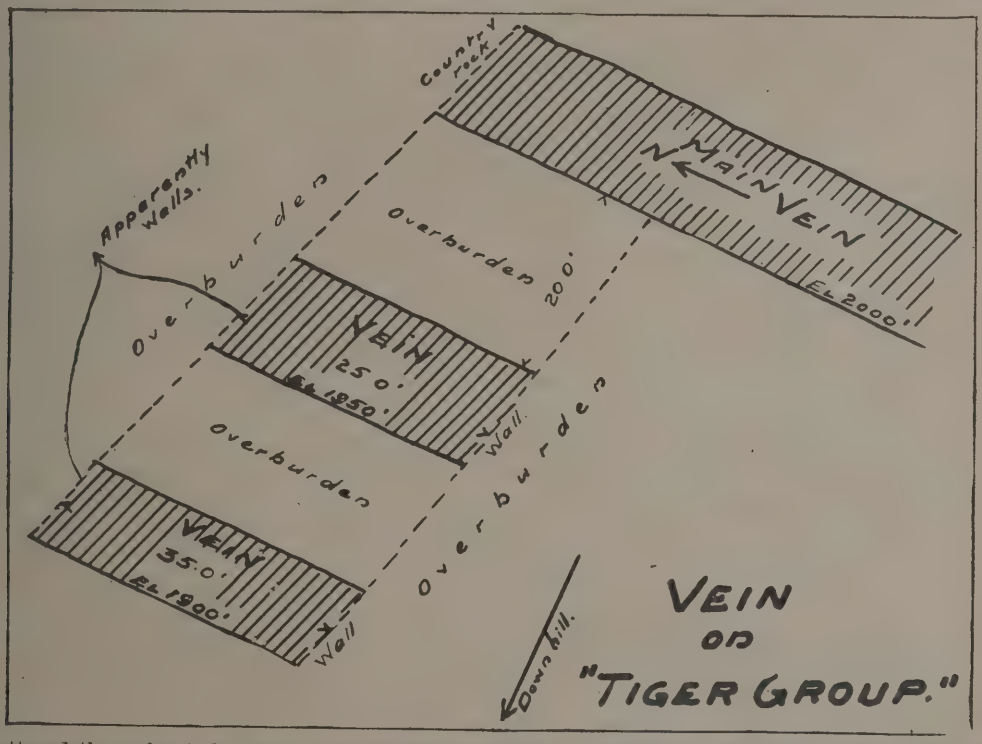
There are two veins on the claims; one, exposed by a 20-foot open-cut and a 10-foot tunnel, shows a 24-inch vein of quartz and country-rock, carrying iron pyrite and a little galena. It strikes east and west and dips 60 degrees to the north. This vein carries small values in silver.

The main vein, discovered this summer, has been opened up at a point 150 feet above the railroad by an open crosscut, showing a 3½-foot vein of barite banded with a reddish rock that looks like jasper, and quartz, in the andesite formation. The whole vein matrix is mineralized with streaks of galena and some pyrite. It strikes N. 80° E. and dips 65 degrees to the north, the same as the *Dolly Varden* vein, and at right angles to the *North Star* vein. A grab sample taken from material thrown back from the face of the open-cut gave assay returns of 0.3 per cent. lead and 17.1 oz. silver a ton, which is sufficiently encouraging to drift on. The vein has

been uncovered in a couple of places farther up the hill. With a sufficient tonnage of this grade of ore, this property, equipped with a small concentrating plant, would be a profitable proposition.

Tiger Group. This group of two claims—*Tiger* and *Lion*—situated north of and adjoining the *Toric* group, is owned by Ed. Pickett, of Alice Arm, B.C. The owner has done very creditable work on these claims and has succeeded in tracing the vein and exposing it for several hundred feet by means of open-cuts and stripping. The vein strikes about north and south, the same as the *North Star*, and dips 68 degrees to the east, and might easily be the extension of the *North Star* vein. It lies in the "silver-belt" formation of andesite.

The cabin on the claims is at an elevation of 1,700 feet, to which there is a fair foot-trail, breaking from the main trail just above the crossing at the foot of the *Dolly Varden* hill. The first showing is just above the cabin at an elevation of 1,800 feet, about 600 feet above the railroad-grade at the foot of the hill on the same side of the river. Here the vein is about 7 feet wide, consisting of 14 inches on the foot-wall, then about a foot of dyke or enclosed country-rock, and the balance of somewhat broken-up vein-matter. The vein is better defined at the next showing above, at 1,900 feet elevation, where it is exposed by an open-cut showing it to be 8 feet wide of hard, vitreous quartz well mineralized with iron pyrite. It is evidently of low grade, for no silver-bearing minerals could be seen at this point. The pyrite occurs



scattered throughout the quartz and in small veinlets and bunches. The vein is again exposed, with a face 10 feet high, by an open-cut about 50 feet farther north and 25 feet vertically up the hill. The width and contents are the same as in the last cut, with the appearance of a little galena, which will no doubt increase the silver values. Another open-cut some 30 feet farther along on the strike of the vein failed to pick it up, being probably a little too high up the hill or the vein overlaid by the country-rock. However, it is again cut about 30 feet farther north, showing an increase in width to 10 feet and an improvement in mineralization, in that there is more galena and some zinc, with traces of silver sulphide. Again, 30 feet farther along, at an elevation of 2,000 feet, another open-cut exposes a width of 12 feet of vein which has been stripped for a length of about 30 feet, where it appears to end abruptly against a face of country-rock. This exposure shows the characteristic pyritized, hard quartz, but in addition it shows patches of ruby-silver, with an occasional flake of native silver.

The mineralization or vein was again picked up about 50 feet vertically down the hill directly under the last showing. (*See* sketch.) Here an open-cut along the side-hill shows ore for a length of 25 feet, extending about 12 feet beyond the end limit of the vein above. The cut is about 12 feet into the hill, and there is a distance of about 20 feet from the top of the cut to the vein above covered with overburden; consequently there is no way of judging as to the continuation of the lower to the upper showing. Both ends of this cut appear to be walls confining the ore.

Still farther down the hill another cut exposes ore along the side-hill for a length of 35 feet, the ends of which also appear to be walls. Both of these cuts show good ore, carrying noticeable amounts of ruby-silver.

I have since been informed that there is a smaller cut below these, which I did not know of, which has the best ore-exposure of all, averaging 46 oz. silver to the ton. At the present stage of development-work it is difficult to form any conclusions as to what has happened to the vein. It would appear that there has been a cross or fault fissure running down the hill which has become filled and part of the vein. The main portion of the vein, that is, on the strike of north and south, may continue from any point on the cross-fissure, or what looks like a cross-fissure may extend indefinitely and be a cross-vein running into the main vein at this point. There is a similar occurrence on the *Musketeer* group, except that the main north-and-south fissure continues beyond the point of juncture with an east-and-west vein. Further work on this may show similar conditions.

This vein is exceptionally well mineralized throughout, and showing, as it does, values in silver in portions of it, may develop shoots of higher-grade silver ore anywhere in it. It is also exceptionally strong, well defined, and regular, and may be expected to maintain this regularity and size at depth. I cannot see where there is any chance for surface or secondary enrichment, as the vein, wherever opened, shows no signs of oxidation or alteration from the primary sulphides.

This is a property meriting extensive exploration.

Musketeer Group.

This group is composed of five claims—*Athos*, *Porthos*, *D'Artagnan*, *Armes*, and *D'Artagnan No. 1*—situated north of the *Tiger* group and south of the *Wolf* property of the Dolly Varden Company. The claims are owned by Miles Donald and Al. Miner, of Alice Arm, B.C. An open-cut 30 feet long and about 8 feet deep, just above the railroad-grade, has been put across the showing; the cut was partially filled in, so that the width of the vein is obscured; however, it shows the characteristic filling, in the andesite fissures, of pyritized quartz and bands of red, jasper-looking rock similar to that in the *Toric* cut, with a little galena. About 100 feet south of this a face of ore has been picked down along a little bluff on the side of a small creek, showing 18 feet in width of silicified rock heavily impregnated with iron pyrite. No attempt has, as yet, been made to trace this showing, but lining it in with the first showing mentioned would give it a strike of east and west, the same as the *Toric* vein. About 200 feet farther south a short tunnel has been driven 14 feet on nothing and shows nothing in the face.

Considerable work has been done by way of open-cutting across a bluff at an elevation of 2,000 feet, the work showing a vein of quartz and barite 12 feet wide, carrying bands and bunches of iron pyrite evidently low grade, striking N. 80° W., and possibly the continuation of the vein mentioned as exposed at the foot of the hill. The course of this vein corresponds to that of the *Toric* and the *Dolly Varden*.

Some 50 feet south of the above exposure another open-cut across the face of a prominent bluff has shown up another vein 18 feet wide, consisting of a hard vitreous quartz with a little barite, heavily mineralized with iron pyrite, and apparently also low grade, as no silver sulphides were seen. This vein strikes north and south and dips 68 degrees to the east, and is therefore parallel with the *Tiger* vein, the adjoining group to the south, and resembling it in every way, except that no silver sulphides have yet been found. The continuation of this vein down the hill would just about hit the "bug-hole," a local name applied to the showing on the *Bonanza Fraction*, situated just across the river. It may be noted that the east-and-west vein joins the north-and-south vein just above these open-cuts, and both terminate at the junction, so far as can be seen. It is rather a peculiar coincidence that the *Tiger* vein or veins appear to do the same thing at about the same elevation of 2,000 feet.

There are on these claims two veins very strong in every way, and although the work done has not shown any commercial ore, yet the portions of the veins opened up are so small compared with the whole that they have little beearing on the possibilities of the balance of the veins.

Wolf Group. This group, adjoining the *Musketeer* group on the north, has been mentioned under the Dolly Varden Mines Company. It may be interesting to note that there are also two veins on this property—the main one, on which the work has been done, striking about east and west, and another striking N. 25° W., or about at right angles, as on the *Tiger* and *Musketeer*, joining each other, but at the bottom of the hill on this property.

Silver Horde Group. This group, consisting of three claims and a fraction—*Silver Horde No. 1*, *Silver Horde No. 2*, *Silver Horde No. 3*, and *Silver Horde Fraction*—is owned by A. Davidson and Al. Miner. The claims adjoin the *Wolf* group on the north and have been surveyed. Two open-cuts, the lower one at 1,600 feet elevation, have exposed a vein in the andesite formation very similar to those described on all the other properties in the same formation. This is between 15 and 20 feet in width, possibly not quite so siliceous as the others, but carrying the same mineralization. The lower cut averages 7 oz. in silver and the upper one 4 oz. in silver a ton. It is either a parallel vein to or the extension of the No. 2 vein on the *Wolf*.

The Granby Consolidated Company diamond-drilled this vein, the results from which are not available, but were evidently unsatisfactory, as their option on the property was not exercised.

Climax Group. This group is composed of two claims—the *Climax* and *Climax No. 2*—and owned by Magnus Oleson. They are situated on the north side of Trout creek, adjoining the *Moose* and *Silver Horde* groups. The vein, lying in andesite, has been opened up by two open-cuts, showing it to be rather different from the other veins, in that it is composed of a greenish, brecciated country-rock, through which small quartz veinlets are interlaced. On the hanging-wall there is about a foot of a more siliceous filling, sparingly mineralized with galena. The vein is about 4 feet wide and has a bearing of east and west, with a dip of 32 degrees to the north. About 30 feet from this the other open-cut shows the same vein-filling. A sample was taken of the best-looking galena-bearing quartz, from which assays gave 14.1 per cent. lead and 14.5 oz. silver a ton.

This is a well-defined vein showing fair values, and, as such, deserves opening up.

Moose Group. This group of four claims—*Moose No. 1*, *Moose No. 2*, *Moose No. 3*, and *Moose No. 4*—is situated adjoining the *Climax* and *Silver Horde* properties. It was staked by Don Cameron after disposing of the *Wolf* to the Dolly Varden Company, and is still owned by him. The claims are about half a mile from the *Wolf* property, to which the railroad will eventually be constructed; therefore transportation will offer no difficulties. All the properties at or near Trout creek have abundant water for power.

On the *Moose No. 1*, at an elevation of 2,450 feet, a short way below the cabin, the face of a straight precipitous bluff has been shot off for a width of 20 feet, exposing a mineralization for practically the whole width, but of which about 6 feet could be considered a vein. It is impossible to tell here positively the strike of the vein. The country-rock is andesite.

Another cut a short distance below this, elevation 2,400 feet, discloses a well-defined vein 14 feet wide, of which about 12 feet on the west side is a mixed quartz and greenstone, while 2 feet on the east wall is very much oxidized and evidently very rich ore. I take this to be the continuation of the vein exposed above in the bluff, although they are not exactly the same strike, and the heavy timber and overburden between prevents tracing them through. This is a fine showing and will produce shipping-ore right away. About 50 feet vertically below this the same vein has been again exposed for a width of 5 feet by an open-cut and tunnel which is about 6 feet underground. It has a strike of N. 45° E. and stands about perpendicularly. This showing is in line with both cuts above and evidently the same vein.

Farther down the hill, about 200 feet, an open-cut 14 feet along the face of a perpendicular bluff exposes a vein 7 feet wide, with a face 12 feet high, running N. 15° W. and dipping 70 degrees to the east. The vein-filling is a broken-up country-rock with veinlets of quartz in all directions, and bands of quartz generally parallel to the dip of the vein. The mineralization is chiefly pyrite and evidently low grade. Its strike shows it to be another vein diverging from the other at about 60 degrees, and would therefore connect with it down the hill.

This is a good-looking property for quick action in shipping, for there is high-grade ore from the surface. I am informed that it is the owner's intention to open up the property himself and put it on a shipping basis.

Last Chance Group.

This group is owned by Archie McPhail, George Kolbeck, and Pat Morley, of Alice Arm, B.C. There are four claims in the group—*Last Chance No. 1*, *Last Chance No. 2*, *Last Chance No. 3*, and *Last Chance No. 4*—situated about three-quarters of a mile from the railroad, up Trout creek on the north side, and adjoining the *Moose* group on the east. There is a foot-trail to the property from Trout Creek camp, on the Kitsault, over the *Climax* and *Moose* properties. There should be a good pack-trail put up Trout creek as soon as one is built up the Kitsault valley from the railway to the head of the river. This upper Kitsault area certainly requires and deserves a first-class trail built on a suitable grade for future conversion into a road. Ore brought from this and adjoining properties to the river by tramway would be about half a mile from the railroad when it is completed through to the *Wolf*, or about three miles from its present terminus at the *Dolly Varden*. Immediate shipping would therefore be impracticable from any property above the *Dolly Varden* until such time as the railroad is completed through to the *Wolf*, or a good wagon-road constructed from the present terminus up the valley. There is a good cabin on the claims at an elevation of 2,600 feet.

The showing consists of a side-hill exposure some 300 feet in length, which has had one open-cut put into it and numerous shots here and there along the surface. It has a peculiar appearance on the surface, in that it consists of all sizes of rounded pebbles and boulders of greenstone in a matrix of barite, quartz, and calcite, carrying pyrite, galena, a little chalcopyrite and blende, and some argentite. The principal values are in silver. A sample taken across 20 feet on the surface assayed 9 oz. silver a ton. Another sample, taken from all the fresh exposures where the shots had been put in, gave 61 oz. silver a ton. The open-cut on the surface has cut into the vein a few feet for a length of 20 feet and shows considerable high-grade galena and argentite.

A crosscut tunnel has been faced up at the foot of the hill, about 30 feet below the open-cut, which will be driven through the showing by the owners as early as work can be undertaken in the spring.

About 100 feet above the open-cut the ground breaks to a broad flat bench. Several holes and strippings have disclosed ore for 20 feet back from the edge of the bluff, but no conclusions can be drawn as to the width of the vein until it is crosscut below.

It is a fine big surface showing, apparently carrying good average values in silver, and consequently merits extensive exploration. The results of the driving of the crosscut tunnel will be of interest, for a proven tonnage of this grade of ore would make a fine flotation proposition, with Trout creek so handy for water and power. It is one of the meritorious prospects of the section.

Camalachie.

The *Camalachie Fraction* is one of a group owned by D. A. McPhail, situated north of and adjoining the *Moose* and *Last Chance* groups. The showing on the fraction consists of a quartz vein, with enclosures of country-rock, lying along a diorite dyke on the hanging-wall. Several shots have been put in, tracing the vein for 300 or 400 feet, and showing it to vary from a few inches up to 6 feet in width. Samples taken by the owner gave assays of 12 oz. silver a ton.

There is a big quartz vein known as the "Blue Bird vein" running through this group and traceable for several thousand feet. I did not get over that part of the claims, but am told that the vein has been exposed in several places by open-cuts, and shows small silver values wherever tested.

Columbia Group.

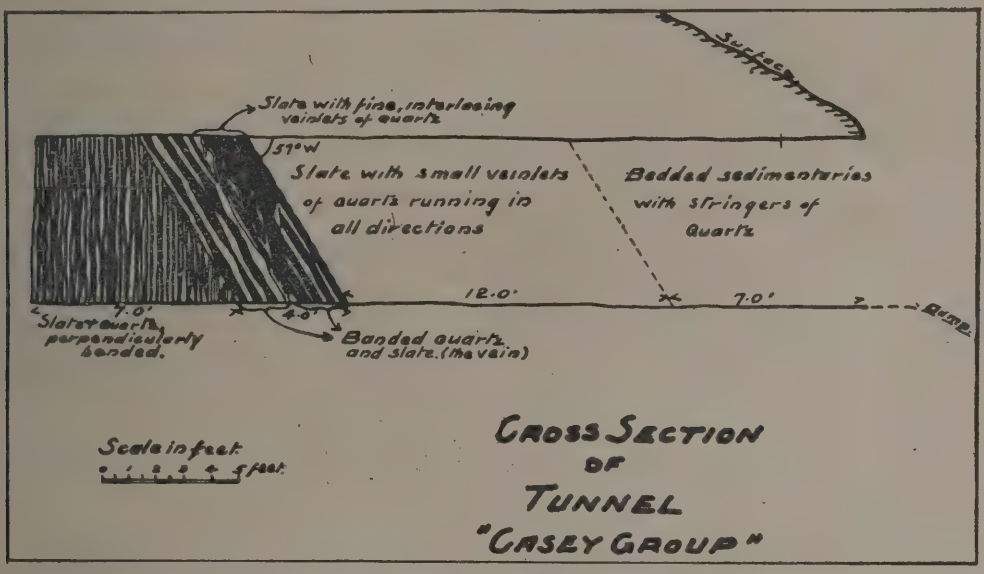
This group is made up of three claims—*Columbia*, *Wanderhoft*, and *Daisy*. They are owned by Pete Anderson and are situated on the north bank of Clearwater creek, about two miles and a half from the Kitsault river, from which there is an old foot-trail. The vein strikes N. 45° W., dips 70 degrees to the north-west, and lies in a sedimentary country-rock. The first open-cut is at an elevation of 2,650 feet, showing the vein to be about 6 feet wide and to consist of brecciated argillite cemented with quartz. As the vein is followed up the creek it varies from almost straight argillite, interlaced with quartz stringers, to almost pure quartz up to 15 feet in width. The slate bedding-planes lie at about N. 35° E. and dip at an angle of 31 degrees to the west, the vein therefore cutting

the formation at about right angles. There are numerous diorite dykes lying with the slates and through which the vein also cuts.

The quartz is sparingly mineralized with pyrite, with occasionally a little chalcopyrite showing. About 40 feet north of the first cut, at an elevation of 2,775 feet, where the creek bends away from the vein, an open-cut has been driven 20 feet, giving a 12-foot face on the vein, following a slip in the vein which shows it to be almost perpendicular. So far no values of any importance have been developed, and its only favourable feature is the size and persistence of the vein.

Second Thought Group.

The *Second Thought (Casey)* group is situated twenty-two miles up the Kitsault river, on the east side, and two miles and a half above the proposed terminus of the Dolly Varden Railway at the *Wolf* property. There are four claims in the group, owned as follows: *Second Thought*, *Second Thought No. 1*, *Second Thought Frac.*, *Big Ben* (half-interest), and *Little Ben* (half-interest), by Geo. B. Casey, of Prince Rupert, B.C., and Jack Graham, of Alice Arm, B.C.; *Big Ben* (half-interest), by R. McGinnis; and *Little Ben* (half-interest), by W. Waldon.



Development-work consists of a crosscut tunnel (*see* sketch) and open-cuts on the surface above the tunnel about 50 feet. One open-cut has been run on the vein along the side-hill for a length of 30 feet, cutting into the vein for 5 or 6 feet. About 20 feet above this, where the vein crops through, is a narrow seam of a few inches thick on the foot-wall, carrying high silver values in argentite, ruby-silver, and some native silver. The strike of the foot-wall is N. 30° E. and the dip of the vein about 62 degrees to the west. The vein-filling is shown on the surface to be mainly quartz, with slate pieces enclosed, and in places banded quartz and quartz and slate.

The tunnel has been driven a distance of 30 feet across the formation, starting from the level of the trail, which gives very little dump-room, but necessary to obtain all the depth possible under the croppings. A cross-section of the tunnel shows from the mouth 7 feet of banded sedimentaries, with small stringers of quartz through it; then 12 feet of a blocky slate or argillite, with small veinlets of quartz running in all directions through it; then a section of 4 feet, the vein, consisting of banded quartz and slate, pitching 57 degrees to the west, and mineralized with pyrite, argentite, and small flakes of native silver, as well as an occasional colour of free gold; the next 7 feet to the face is principally slate perpendicularly banded with quartz, slightly pyritized, and with traces of native gold and silver. The tunnel should be continued through to the slates, which appear to form the foot-wall of the vein, and I would also drift on the 4-foot vein of ore. A grab sample was taken from the dump of the quartz from the tunnel and gave assays of: Gold, trace; silver, 8 oz. a ton. A sample of the last 11 feet of the tunnel would probably average better than this, which, I consider, very encouraging, as the ratio of concentration would reduce the mineral content to a high-grade concentrate.

About 100 feet south of the tunnel, just off the trail, another vein crops showing a width of 6 feet of quartz, with fragments of slate embedded in it, giving it a mottled appearance. Specks of argentite can be seen in the quartz, and it is stated that native silver has also been found. This showing averages 9.5 oz. silver across the 6 feet. Another open-cut some 500 feet farther up the hill shows the extension of the vein to be about 2 feet wide and containing traces of silver sulphides. It strikes N. 10° W. and dips at 35 degrees to the west; the two veins are therefore converging with depth. No work has been done on this vein, but it is surely worth some exploration.

Taking everything into consideration, this property has a very promising appearance, and with the railroad completed through to the *Wolf* will be well situated for transportation. A great deal of depth is not obtainable on the main vein without sinking, but the other can be drifted on from the surface.

Black Diamond Group.

This group, consisting of eight claims—*Black Diamond No. 1*, *Black Diamond No. 2*, *Black Diamond No. 3*, *Black Diamond No. 4*, *Silver Bell No. 1*, *Silver Bell No. 2*, *Silver Bell No. 3*, and *Silver Bell No. 4*—is owned by John Hauber *et al.* The claims are located on the extension of the quartz vein on the *Columbia* group. I had not time to go over these, but am informed by the owners that there are two or three open-cuts on the vein and that native silver has been found.

Homestake Group.

This group is comprised of four claims—*Homestake No. 1*, *Homestake No. 2*, *Homestake No. 3*, and *Homestake No. 4*—and is owned by A. Davidson, Gus Pearson, and A. Smith. They are located along the west side of the glacier, twenty-six miles up the Kitsault river from Alice Arm, the four claims being staked along the vein. The main trail up the valley extends through to the property, although the upper two miles, after it crosses to the west side of the river, is not much of a trail. A great deal of credit is due the owners of this property for the amount of prospecting and work done on their claims, under very difficult and discouraging conditions. The completion of the railroad to the *Wolf* will put this portion of the country within five or six miles of transportation, and through a part not at all difficult to build a wagon or sleigh road.

The showing on the *Homestake* consists of a vein or mineralized zone extending the length of the claims, on a strike of east and west, paralleling the river, and dipping at 62 degrees to the north. The lower end of the vein is at an elevation of 3,400 feet, which is probably 500 feet above the glacier-flat or the old bed of the glacier. The ledge could be crosscut from this flat with from 200 to 300 feet of tunnel, thus providing a camp-site down in the timber, where a trail could be easily built to it, and obtain a depth of about 500 feet on the vein. The mineral zone has been crosscut in numerous places, disclosing a width up to 35 or 40 feet in places of altered and silicified greenstone mineralized with pyrite, galena, and, especially on the upper end of the zone, chalcopyrite. The rock formation is a greenstone or a greenish andesite containing many of these siliceous belts.

About 600 feet from the lower or east end of the zone it has been exposed by an open-cut, about 4 feet deep, for a width of 35 feet from the hanging-wall without reaching the foot-wall. Probably 150 feet farther west another cut shows the zone to be more siliceous and heavily mineralized with a very fine-grained iron pyrite, the foot-wall portion showing considerable galena.

Another cut, farther west about 75 feet, crosses the vein, following a small gully, the sides of which were also broken into. Traces of grey-copper were noted in this cut. Both walls are of greenstone.

The vein is again cut 50 feet farther west, showing a width of 35 feet, heavily pyritized, very little galena, but an appreciable amount of chalcopyrite. This is the best-looking showing so far, and for the depth obtained, not more than 4 feet, looks very promising.

Fifty feet farther west shows the walls of the zone to be very little altered from the country-rock, with the centre more siliceous and very well mineralized.

About 60 feet farther along on the vein there is more greenstone and less silicification than in any of the cuts, but shows a little chalcopyrite and galena.

A cut has been put in, about 20 feet west, at a point where a cross-vein meets the main one. The smaller cross-vein carries chalcopyrite, and at the juncture the mineralization in the main zone is heavier in copper sulphide than elsewhere. The small vein has a strike of N. 70° E.,

and has been opened up below, towards the glacier-flat, by two or three open-cuts. The first one, 75 feet from the main vein, shows a width of 6 feet of good quartz-copper ore, while 100 feet lower there is a very good showing of solid chalcopyrite, pyrite, and a little galena. Farther below it again crops in a small creek, where there is about a foot of good galena in a big oxidized capping which is certainly worth getting under. This small vein would make an excellent tunnel-site to get under the western portion of the main zone from the glacier-flat, and would serve the double purpose of prospecting the vein itself as well as tapping the main one.

On the extreme west end of the main vein, where it crops on the end of the hill about 100 feet above the glacier, an open-cut with a face 12 feet high in the vein exposes a width of 18 feet of vein-matter, of which about 4 feet on the foot-wall is good chalcopyrite, the balance being a mixed-up, oxidized material composed of broken-up greenstone, with galena and chalcopyrite deposited in the oxidized seams. No attempt was made to sample the showing, for it would require moiling to obtain an average across the cuts, and would take more time than I had at my disposal.

Taking into consideration the width and continuity of the vein, the persistence of the mineral content, the improvement in appearance in what little depth has been gained in the open-cuts, the grade of ore exposed in some of the cuts, and its favourable situation for mining, there are good reasons to believe that this property might easily develop an immense tonnage of concentrating-ore. As pointed out, deep development can be economically obtained by a crosscut tunnel to the vein on the lower end, or a drift on the cross-vein to the upper end of the main vein, or by drifting in on the ore from the upper end above the glacier and tramming the ore around the hill.

Matilda. This claim, owned by Arthur Smith, is situated on the side of the mountain, above the *Homestake* group, at an elevation of 4,100 feet at the tunnel This has been driven 30 feet on a silicified greenstone vein, in which are finely disseminated iron pyrites. The tunnel has a bearing of S. 30° W. Ore on the dump shows galena and chalcopyrite, which comes from a small open-cut above the tunnel, showing about 4 feet wide of very good-looking ore. It apparently is only a bunch, as the tunnel, driven just below it, failed to show it. There is a wide belt of this altered greenstone here, about 30 feet, lying in a greenstone or andesite country-rock, with a strike of about S. 70° W.; the tunnel therefore cuts diagonally across the mineral. A sample of the best-looking galena gave 16.3 per cent. lead and 2.4 oz. silver, with a trace of gold.

The claim is worth keeping up the assessment on until improved transportation lessens the difficulties and cost of development-work.

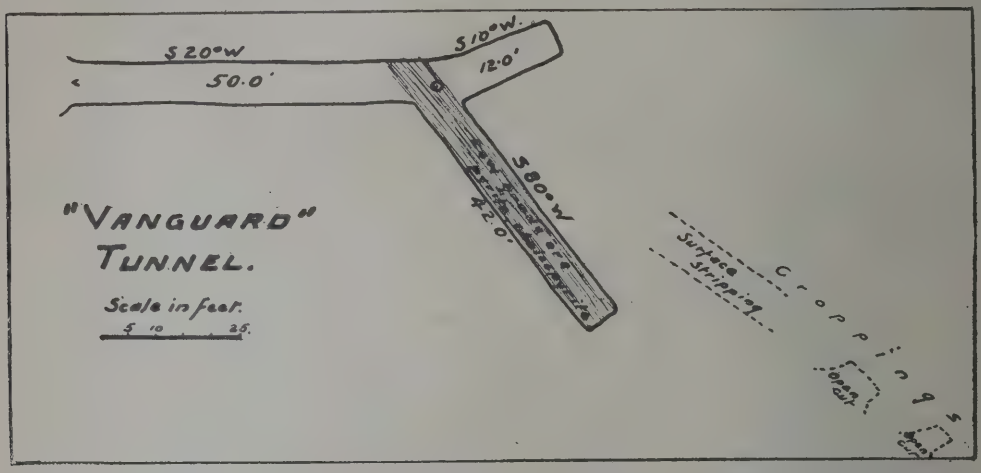
Tip Top. This claim is situated at the same elevation as the *Matilda* claim and a little farther south along the hill. It is owned by H. Mann. The showings are identical with the *Matilda*, being an altered greenstone heavily mineralized with pyrite and also a little chalcopyrite. There are four open-cuts on this claim, on as many veins; in fact, the whole side of the mountain seems to be a series of these altered zones in the greenstone. The copper content, so far as exposed, is too low to be of commercial value until such time as cheap railway transportation is available.

Fox. This claim and a fraction the name of which I did not get, owned by O. Flint, are situated south of the *Tip Top* claim, along the mountain-side, above the *Homestake* group. Again there is the same character of vein as on the *Matilda* and *Tip Top* claims, a greenish, siliceous filling carrying pyrite and a little chalcopyrite. The vein stands perpendicularly and strikes S. 70° W. up the hill. A tunnel has been started at an elevation of 4,000 feet and driven 6 feet on the vein, here showing about a foot of almost solid pyrite, with considerable chalcopyrite in bunches and small seams. This is a fair showing and justifies the extension of the tunnel.

Vanguard Group. This group of four claims—*Vanguard*, *Nimrod*, *Nero*, and *Mother Lode*—is situated on the west side of the Kitsault river, about twenty-four miles from Alice Arm. The claims are owned by Morris Peterson and the Strombeck Bros., who have certainly shown their confidence in the property in the large amount of prospecting and development work done. There is a fair foot-trail branching from the main trail along the river to the cabin, at an elevation of 2,850 feet, about 1,000 feet above the valley. From the cabin the trail has been extended to the tunnel and other workings on the upper end of the claims.

At an elevation of 3,000 feet, a fine showing of chalcopyrite has been exposed by means of two open-cuts about 15 feet apart on the vein, which has a strike here of S. 70° W. and a dip of 62 degrees to the north, with the slope of the hill. The first or east open-cut shows the vein to consist of a dark, coarse, somewhat altered greenstone, siliceous in places, and almost entirely replaced by solid chalcopyrite for a width of about 8 feet. The other cut, 15 feet farther along on the vein, shows it to be rather broken up and oxidized, but containing solid bunches of chalcopyrite. This showing and the continuation of the vein up the hill must lie very close to the contact between the greenstone and sedimentary formations, as the latter was noted in crossing High Grade creek a short distance up the hill.

From a point about 20 feet south of the first cut the vein has been stripped for 40 feet down the hill, exposing a width of from 4 to 8 feet of chalcopyrite, in which are included small bunches of country-rock. This exposure, with the two cuts above, is an exceptionally fine showing of chalcopyrite which could be easily hand-sorted to a high-grade shipping-ore.



About 40 feet below the lower end of the above stripping a tunnel has been driven at an elevation of 2,900 feet on a bearing of S. 20° W., intersecting the vein at a point 50 feet from the portal and extended 12 feet farther into the wall. A drift was run for 42 feet on the vein which strikes S. 80° W., showing its content to be light grey-coloured, rather siliceous rock, fairly well pyritized and carrying a slight amount of chalcopyrite in the face. It is a disappointing showing when compared with that on the surface above, but the tunnel should be continued, as the ore-shoot in the vein may rake into the hill, in which case the drift is not in far enough to reach it.

Some 300 feet south of the tunnel along the side-hill a showing of solid chalcopyrite 4 feet wide was first disclosed by an open-cut, under which a tunnel was run later, but which failed to find the continuation of the surface showing going down. This tunnel is now being continued into the hill on the assumption that the isolated showing on the surface has broken off the vein farther up the hill. This vein has been stripped farther west along the trail, exposing a width of 5 feet, containing bunches of chalcopyrite through it. It has the same strike as the main vein.

This is another property in this section that could ship a small tonnage of hand-sorted ore of a high grade if the transportation facilities were available. It has as fine a surface showing of ore as one could expect; is well located for mining purposes; has plenty of timber for all needs; can obtain water for power purposes from any of the local creeks; and, with a tramway, can deliver ore to within three miles of the railroad when completed through to the *Wolf* property.

Copper Cliff Group.

This group is made up of four claims—*Copper Cliff*, *Copper Cliff No. 1*, *Copper Cliff No. 2*, and *Copper Cliff No. 3*—situated on the west side of the Kitsault river, just opposite Trout creek. The owners are J. Wells, A. Davidson, and J. E. Juggins, of Alice Arm, B.C. The showing on the property is a belt several hundred feet wide of oxidized, yellowish-red stained rock on the surface and light grey when broken into, rather soft and disseminated with pyrite, in which can be seen a little chalcopyrite. The zone lies along the contact of the andesite and sedimentary formations, and in

the andesite, which has been somewhat altered and slightly silicified and pyritized. On the east side of Gash creek, which cuts across the belt, a low-grade copper-bearing vein crops, running N. 30° E., whose width at this point could not be determined. The vein is a somewhat siliceous, darker-coloured rock, full of iron pyrites which carries a small percentage of chalcopyrite. Above the cropping an open-cut has been dug along the hillside for a length of 30 feet, of which about 6 feet in width is fairly good copper ore. The formation throughout is the lighter grey, slightly pyritized rock. At an elevation of 2,550 feet a crosscut tunnel has been driven 45 feet toward the above-mentioned cropping and open-cut. Judging by eye, it will require a further 50 feet of driving to get under it.

North-west of the tunnel about 100 feet and across the creek the Granby Consolidated Company ran a diamond-drill hole from the argillites into the red-stained formation for a length of 170 feet, and, I believe, found nothing of sufficient value to warrant any further work on that side. Some drilling was also done farther north-east along the contact into this zone, with, I suppose, unsatisfactory results, as nothing more was done.

Some good float of chalcopyrite has been found below the zone, and it seems reasonable to think that, somewhere in such an immense mineralized belt, commercial ore will be found. The property is only about a half mile from the Kitsault river in a straight line, so that transportation is not a handicap.

Carpenter. The Carpenter-Egan claims, *Ouray* and *Bertha Fraction*, are situated on the west side of the Kitsault river, opposite the *Wolf* camp and adjoining one of the *Wolf* claims lying on the west side of the river. The claims are owned by Albert E. Egan and B. J. Carpenter, of Alice Arm, B.C. At an elevation of 1,500 feet, about 300 feet above the river, several open-cuts have been put in, tracing the vein along a ridge, running south and north into the hill. The vein has not been completely crosscut in any place, so that the width is indefinite. It is shown to be composed of quartz, with considerable calcite mineralized with pyrite, chalcopyrite, and a little galena, and lies in andesite formation. The vein lies very close, about 40 feet on the north end, to the *Wolf* line, and with its dip will no doubt extend into *Wolf* ground. Work on that end of the vein, however, proves it to pinch out, better part of the ore extending south and gradually getting away from the side line. There is some very good-looking copper ore showing in the cuts, but sufficient work has not been done in any one place to be of much use in showing up the vein.

A sample obtained by taking a few pieces from each cut in an effort to get an average of the ore gave only a couple of ounces of silver, with a trace each of copper and lead. The general appearance of the ore would suggest higher values than this. There is supposed to be an opening on the south end of the vein showing some fine ore, but in the absence of the owner I was unable to locate it. The vein can be opened at the foot of the ridge on the south end by drifting on it. I was very favourably impressed with the showing and its location.

Trouble. The *Trouble Fraction*, owned by A. Davidson, is on the west side of the Kitsault just at the bridge crossing to Davidson's cabin. The owner had just put a couple of shots into the showing at the edge of the water, which had exposed a considerable width of greenstone, shot full of small veinlets of quartz and calcite, carrying a little pyrite and galena. A little east of the present exposure there appears to be more quartz, but it had not been broken into. The showing as yet does not look important.

Bonanza. The *Bonanza Fraction*, owned by Miles Donald, Charles Swanson, and Al. Miner, lies on the west bank of the Kitsault just above the *Big Canyon*. An open-cut across the face of a precipitous bluff overhanging the river shows a vein in andesite 18 feet wide, consisting of quartz mineralized with considerable pyrite and a little galena. It is directly in line with the north-south vein of the *Musketeer* group and is similar in every way. A crosscut tunnel is being driven from the side of the bluff toward the vein as a more convenient point of attacking it than in the face of the bluff. It has been driven 18 feet and will require 10 feet more. The work on this fraction was done by the operators of the *Kitsault* group for that property, but when the group was surveyed the fraction contained all the work. It is a strong showing, but the ore disclosed so far is low grade.

Wild Cat Group. This group of four claims—*Wild Cat*, *Montana*, *Slocan*, and *Medallion*—is owned by Davidson & Macey. The claims are situated on the west side of the Kitsault above Homestake Creek bridge. At an elevation of 1,750 feet a couple of shots have been put in on a surface showing, exposing about 4 feet of a vein of copper-

bearing quartz, in which is considerable greenstone. The walls of the vein are the typical light greenish-grey, somewhat silicified rock, disseminated with iron pyrite near the copper-bearing vein. This vein, being more siliceous, looks more promising, for as a rule the copper sulphide occurs in a greenish hornblendic rock in small patches along the oxidized seam and in decomposed spots, giving the impression that the mineral has been deposited from surface waters and therefore will not be found at any depth. The above-mentioned vein is fairly well defined, striking at N. 70° W., dipping 45 degrees to the north-east, and merits further work.

East of this vein about 100 feet and running toward it are two basic dykes cutting across another vein which has been open-cut below at an elevation of 1,600 feet, exposing a width of 2 feet of dark-green rock heavily mineralized with chalcopyrite. This vein runs N. 40° W. and stands about perpendicularly, and will therefore intersect the upper vein to the west of it. A sample across 16 inches of this copper ore gave assay returns of 7 per cent. copper and 3 oz. silver a ton. The rock next to the ore is quartz-stringered and shows a low copper content. No drifting has been done on this to open it up, but it looks as if some good shipping-ore could be sorted out of it. A tunnel at 1,450 feet elevation has been driven 125 feet toward getting under this showing, following the east dyke of the two mentioned above it. The vein runs to this dyke and there should be no difficulty finding it if it continues in depth.

There is a good mining equipment at the tunnel and work will be pushed ahead as soon as possible by the owners. This property has a good chance to develop into a producer and is ideally situated in every way. The tunnel is about 650 feet above the railroad, which solves the transportation problem.

Illiance River Section.*

Silver Bell. This claim, owned by Al. Clary, Alice Arm, is situated on the south slope of McGrath mountain, to which there is a fair road from the beach. The showing at 600 feet elevation consists of a dioritic dyke or vein 15 feet wide, throughout which are stringers, bands, and bunches of quartz, carrying pyrite, arsenical iron, and some zinc-blende and galena. It has been opened up by an open-cut for 6 feet and continued in a tunnel across the vein for 12 feet farther. The vein strikes N. 15° E. and dips 55 to 60 degrees to the east. A sample was taken from a pile of ore on the dump which gave returns of: Silver, 0.6 oz.; lead, trace; zinc, 2.8 per cent. This is a big vein and further work would have to be done to draw any conclusions as to its possibility. The claim lies on comparatively flat bench; consequently any depth on the vein would have to be procured by sinking.

Lone Star Group. This group, consisting of five claims—*Lone Star No. 2*, *Clipper*, *Silver Standard*, *Silver Standard No. 1*, and *Silver Standard No. 2*—is situated on the south side of McGrath mountain, adjoining the *Silver Bell* mineral claim and about three miles from the beach. The claims are owned by G. W. Morley *et al.*, of Alice Arm, B.C. At an elevation of 700 feet a tunnel has been driven across a 25-foot vein of grey quartz, in which are bands of pure white quartz running in all directions. The whole is considerably pyritized and also contains some arsenopyrite which apparently carries gold values in this particular section, the owners claiming as high as $27 a ton in this ore. The vein has about the same strike as the *Silver Bell* vein below, but is a different vein. A grab sample from the dump gave only low values in gold and silver.

Just across a small creek from the tunnel is a formation of schistose argillites and slates carrying disseminated pyrite, and throughout it interlaced quartz stringers are mineralized with galena and zinc. No work has been done on it and the ore does not look to be of commercial grade on the surface, but from its general appearance some work is warranted. The schists are bedded on a strike of N. 30° E. and dip 75 degrees to the north-west.

Silver Band Group. This group is situated on the north-east slope of McGrath mountain, about four hours' walk from the beach at Silver City townsite. There are four claims in the group, owned as follows: *Sunrise*, by A. Clary; *Silver Bands*, by G. W. Morley; *Lucky Strike*, by Hillier; and *Tip Top*, by J. Hutchison. On the *Sunrise* claim, at an elevation of 3,600 feet, several open-cuts have been made on as many veins of banded quartz and slate, the siliceous portion carrying mainly sphalerite or zinc-blende, with a trace of galena. The country-rock is slate, very hard and siliceous in places near the

* *See* Turnbull's report, Minister of Mines' Report, 1916.

vein, and so badly distorted and broken up that it is impossible to decide as to the continuity of the ore-shoot. At this elevation there are at least three croppings, varying in width from 2 to 10 feet, all badly oxidized on the surface; the enclosed slates seemingly altered to a soft, brownish, easily pulverized rock.

Farther south about 200 feet, on the *Silver Band* claim, a big showing of slate and quartz 30 feet in width has been exposed. The vein-filling here shows a banded or lenticular structure of oxidized material and quartz up to a foot thick, carrying zinc-blende and traces of galena, and long, narrow bands and kidneys of pure zinc-blende. I should judge the slate content would aggregate about half of the total width of 30 feet. This is a big showing, but cannot be traced on the surface any distance; the amount of work done is very small toward opening up or proving such an extensive showing. It would take a crosscut tunnel 500 or 600 feet long from the valley to get under the cropping, but which would give probably 300 feet in depth, with a good chance of cutting other veins; otherwise the showings would have to be sunk on.

Some 1,500 to 1,800 feet north of this showing, on the *Lucky Strike* claim, what is probably this same vein is cut by a deep gulch. An equal depth could be obtained at this end of the vein by a shorter tunnel, but it would be a much more difficult place to work. The elevation here is 3,750 feet, and the strike of the vein N. 50° W., about the same as the first showing described. A sample from this end of the vein gave 7.5 per cent. zinc, with only a trace each of silver and lead.

The property would have to be developed as a zinc proposition only, judging from the scarcity of galena and silver in the surface showings. The price of zinc since the war is over will very likely go down to pre-war prices; consequently the outlook for such a property is not very encouraging.

Standard Group. This group of four claims—*Standard, Standard No. 1, Standard No. 2,* and *Standard No. 3*—situated on the south side of McGrath mountain, is owned by Billy McLean, Olsen, and Donnelly. It is a short distance off the main trail going from the beach to the *Silver Band* group, which is the highest of the showings on McGrath mountain. On these claims, at an elevation of 2,800 feet, there is an open-cut along the side of the hill 60 feet in length, exposing a vein of quartz the full length of the cut. In the total distance I doubt if a 10-lb. piece of quartz could be broken from the ledge not showing zinc-blende. It is impossible to decide positively the strike of the vein, but to all appearances the open-cut is across or possibly a little diagonally across it. The quartz carries disseminated zinc-blende, bunches of zinc-blende, and bands of solid zinc-blende up to 2 feet thick. It is the biggest showing of zinc ore I have seen, and since there is no other mineral in the quartz but zinc sulphide, it is an ideal concentrating-ore. The ratio of concentration, I should judge, would be about 6 into 1. A sample from this cut of good-looking zinc ore taken for the purpose of getting the silver values gave returns of 48 per cent. zinc and 0.6 oz. silver a ton; it is therefore a straight zinc ore.

Lower down the hill, along a small creek, two or three open-cuts have been put in on a quartz ledge which may be the continuation of the other showing if the vein runs up and down the hill, but a parallel vein if the big one cuts diagonally into the hill. These lower showings look well for the amount of work done and show traces of galena. Conditions are perfect for opening up this vein—plenty of timber, splendid tunnel-sites, and transportation by tramway to the beach.

Kent. This claim is owned by W. Bradley and is situated on the trail to the *Standard* group. An open-cut along a small creek discloses a showing of quartz and calcite about 12 feet wide, of which 6 feet contains considerable slate, the whole filling carrying zinc-blende. The vein strikes north and south and dips very flatly at from 20 to 25 degrees to the east. Directly across the creek exactly the same mineralization lies higher up the hill, suggesting the faulting of the vein. The showing is not important, with zinc at a normal price.

Maple Leaf. This claim, owned by J. B. Adams, lies just across the creek from the *Kent* claim and contains what may be the extension of that vein. A tunnel has been driven 10 feet, showing a foot of quartz on the hanging-wall; then a mixture of quartz and slate to the black slate foot-wall. The ground is badly distorted. Some gold values are said to have been obtained in the quartz, and for such it might be worth more prospecting.

Ingraham's

Ingraham's claims are situated about eleven miles up the Illiance river from tide-water, on the east side of the river and about 100 yards from the main trail. I did not get the names of the claims. A vein about 12 feet wide, of what appears to be an altered lime with quartz stringers through it has been exposed by an open-cut at an elevation of 2,100 feet. The country-rock is probably sedimentary. On the hanging-wall the quartz is more predominant and the mineralization, of stringers and bands of iron pyrite, heavier. The hanging-wall is not well defined, but appears to be on the schistose country-rock, with a small, separating stringer of decomposed quartz. The face of the open-cut is about 10 feet wide and 8 feet high. The surface is stripped for 30 feet back from the face, showing massive pyrites for a width of 4 feet. A sample of this gave only 0.02 oz. gold and 0.2 oz. silver a ton, and no copper. No sample was taken of the pyritized quartz, which may possibly be of better grade than the straight pyrite.

United Metals.

The United Metals Mining Company holds three claims—*Joplin*, *Silver Star*, and *Silver Horde*—situated fourteen miles up the Illiance river on the west bank. There is a good cabin on the property and three men were employed at the time of my examination. D. J. Hancock is in charge of operations. The main trail from the beach to the head of the Illiance river runs across the claims; the upper two miles is in poor condition.

Considerable work has been done on the property during this year; in fact, there had been comparatively little development done for the three or four years previous in which the property was worked. All exploration so far has been practically on the surface, as there is little chance to obtain much depth by tunnelling, as the rise up the bottom of the valley is gradual, and the gulch formed by the Illiance river is shallow along here so close to the head of the river. The showings are small quartz veins lying in the sedimentary country-rock, and for the most part conform with the general stratification in strike, N. 45° W., and dip. The ore-shoots appear to be long, narrow, lenticular-shaped deposits whose continuity in length and depth is very irregular. The general mineralization consists of galena and zinc-blende, carrying high values in silver. There are so many of these small veins that it should be profitable to work them, as several would be producing ore while others were being explored.

Just above the cabin a showing has been exposed by an open-cut and stripping for a length of 60 feet, showing from 6 to 18 inches of high-grade ore. A depth of about 40 feet can be secured under this showing by means of a drift-tunnel from the cabin flat, and should the ore extend to that depth will produce a considerable tonnage.

Farther north another kidney of ore has been disclosed and partially mined for a length of 80 feet, and probably 10 tons of ore sorted and sacked ready for shipment. Just west of this, along a small creek, another vein has been cut showing some ore, but is not being worked at present. North of the cabin about 100 yards another vein has been stripped in several places, showing ore which will be opened up later.

Along the west bank of the Illiance river, here a small creek, a 6-foot open-cut has exposed a nice showing of high-grade ore with a face 12 feet high. The greater part of this has been left in place and about 4 tons piled at the mouth of the cut. This pile was sampled, giving 11.5 per cent. lead and 160.6 oz. silver a ton. Just opposite this, on the east side of the creek, a flatter vein has been uncovered about 20 feet long by 8 feet in width, showing it to be small and frozen to the foot-wall. About 200 feet farther south on the river a cross-vein has been open-cut on each side of the river, showing about 8 inches wide of high-grade ore; a sample from small piles thrown out to be sorted gave 7 per cent. lead and 53.4 oz. silver a ton. This is the only cross-vein (strike north and south) seen so far and may be only a local swing or fold in the schistose formation.

A pile of about 20 tons of ore had been packed to the cabin from the different showings, from which a grab sample gave assays of: Silver, 123 oz.; lead, 15.5 per cent; zinc, 24 per cent.

Ore produced from this property or section will have to be packed to the beach on horses. The trail for the first eight or ten miles from the beach is in fair condition, except for grades (seemingly no regular grade was attempted), while the upper four to six miles will require considerable work in spots to put it in good condition for packing. I am informed that a contract has been let for packing out a guaranteed tonnage, and for this purpose a train of twenty pack-horses will be taken in in the spring. Another active season's work such as this should put this

property in good shape to maintain small, regular shipments of high-grade ore. The maintenance of a first class pack-trail is thoroughly warranted by the showings on the upper Illiance river.

Silver Bell Group.

This group consists of five claims, as follows: *Silver Bell* and *Sapphire*, owned by Joe Hayes, W. W. Moore, and Mrs. McGrath; *Top Notch*, owned by Mrs. McGrath and Joe Hayes; *Balmoral*, owned by W. J. Bradley; and *Lake View*, owned by Major Christie. Joe Hayes, of Alice Arm, B.C., has charge of the property. All five claims are included in bonding the property, but only the *Top Notch* and *Balmoral* were grouped for assessment purposes for the year.

There is a good cabin on the claims at an elevation of 3,200 feet. A lot of open-cutting and stripping has been done for assessments. On the *Silver Bell* claim there is an open-cut for 120 feet in length, following a small vein for the whole distance, which crops in bunches of high-grade ore. The strike of the vein is N. 45° W., following the general bedding strike of the schistose country-rock. On this property, as on that of the United Metals Company, very little depth has been obtained on any of the showings; consequently no conclusions can be drawn as to what the possibilities are at depth. It would be possible to procure a depth of about 100 feet by driving a crosscut tunnel from the main valley, on the east, into the hill. On the same claim, about 150 feet north of No. 1 open-cut, another cut has been run along another vein for 50 feet, with a strike of N. 60° W., showing the same character of vein as in No. 1 cut. The croppings of all these veins are a reddish-brown decomposed schist, the appearance probably caused by the oxidation of the pyrite disseminated in the schist adjoining the veins, the general schist formation carrying no pyrite. An open-cut has been run across this vein, about 30 feet from the end of No. 2 stripping, from a small gulch, giving a face 20 feet high on the vein and showing about 8 inches of ore. A further stripping, No. 3, then extends along the vein for 45 feet from the open-cut just mentioned to a cross-dyke of greenish dioritic rock about 20 feet in width. There is a fair cropping of ore along this stripping, of from 4 to 12 inches in width, of quartz carrying galena and pyrite. A sample knocked off along this ridge of ore gave returns as follows: Silver, 12.4 oz.; lead, 1.5 per cent.; zinc, 5.4 per cent.; showing that a concentrate of lead would make a very high-grade ore if the silver were all contained in the galena. Very little grey-copper was noticed in the ore along here.

Two hundred feet north of the north end of No. 3 stripping, and evidently the continuation of the same vein, an open-cut and stripping, No. 4, has been made for a length of 60 feet. This work has disclosed a vein 4 feet wide, consisting of small veins of quartz mineralized with galena, chalcopyrite, grey-copper, and possibly a little argentite, on either side of a finely laminated, more or less oxidized schist. This showing is an improvement over No. 3, in that the width of the showing admits of more possibilities. The strike of this portion of the vein is N. 50° W. and the dip vertical. In places there are small quartz veins within the enclosed schists in the vein, making the showing well worth obtaining depth on. It would be necessary to run a long open-cut or a tunnel to obtain any depth here, as the surface water, since the showing is in the bed of a gulch, would make sinking impossible for prospector's work. An open-cut from No. 3 stripping would give approximately 40 feet in depth. A sample was taken by knocking off pieces of quartz here and there all along the showing, and represents probably an average width of 18 inches of ore. The sample assayed: Silver, 49.5 oz. a ton; lead, 8 per cent.; copper, 5.6 per cent. An excellent grade of shipping-ore could be hand-sorted from this, and a small mill would produce a very high-grade concentrate.

On the *Sapphire* claim an open-cut and stripping, No. 5, elevation 3,575 feet, about 80 feet long, exposes a capping of yellow oxidized schists, tufaceous in appearance, with a few croppings of ore here and there. The work is not sufficient to show anything of importance. The vein strikes at N. 45° W. Extending for 200 feet or more north of No. 5 cut are a number of cuts put in to trace the vein through, but the formation is badly distorted and the general strike of the formation is more to the west.

West of the open-cuts just mentioned, about 75 feet, is a strong outcropping, striking N. 30° W., which has only been exposed in a couple of small open-cuts about 50 feet apart, and which joins another outcropping, exposed in a big knob, about 30 feet farther north at an elevation of 3,625 feet. At this point, No. 6 stripping, it has been crosscut for 12 feet, showing a good rib of ore about 2 feet wide in the centre and several smaller veins protruding through the oxidized schists for a width of 30 feet. This showing suggests that the two veins, more or less traceable all the way up the valley, have come together here in a broken-up, twisted area. An

open-cut about 100 feet north of the junction of the vein exposes the extension of the vein at an elevation of 3,650 feet, the last work on the *Sapphire* claim. A sample taken from a small pile of ore gave assays of: Silver, 17.5 oz. a ton; copper, 3 per cent.; lead, 4.5 per cent.

Continuing north on to the *Top Notch* claim, extensive open-cutting and stripping has been done for a length of 100 feet, the cuts in places being 12 feet in depth and 12 feet wide. This work traces a vein along a greenish-coloured dyke about 20 feet wide running with the formation at N. 50° W. The dyke is very persistent and can be seen 1,000 feet away. There are a few separated croppings of ore showing in this cut, but nothing important. A sample of ore taken from the cuts gave: Silver, 6.6 oz. a ton; lead, 6.5 per cent. About 100 feet more stripping has been done farther north on the *Top Notch* claim, but there is nothing important showing.

Just south of and about 150 feet west of No. 6 showing an open-cut has been put in on a brown, oxidized-looking rock for a width of 30 feet, in which are found small bunches of chalcopyrite. The same cropping can be traced down the hill, but this is the only place it has been broken into. A sample of the rock gave: Copper, trace; silver, 0.8 oz. a ton; and a test for manganese, which its appearance suggested, gave 3.5 per cent.

Judging from the number of ore-showings, their size, and the grade of the ore, there are reasons to believe that a sufficient number of these showings could be opened up and enough ore extracted to furnish a small concentrator, or be hand-sorted to a shipping-grade and the property made profitable.

Glacier. This claim, belonging to Mrs. Bromley, is situated about a mile over the divide on the Nass River side, on the west side of a small creek running from the summit into the Tchitina river, which flows into the Nass river. There is a tunnel about 12 feet long driven on the vein and two open-cuts just above the tunnel. The vein is quartz and slate, slightly pyritized, with from 4 to 12 inches of ore on the foot-wall, of the characteristic high-grade ore of this section. The formation here is a chloritic schist, probably overlain by igneous rocks, judging from the amount of such in the creek-bed. Lack of transportation makes the showing unimportant.

Yankee Boy. This claim, owned by R. Y. Ingraham, lies just opposite the *Glacier* claim across the creek, and doubtless contains the same vein. I did not know of the claim or showing when there; consequently did not see it.

Monarch Group. This group, consisting of the *Monarch* and *Monarch No. 2* mineral claims, staked by J. E. Stark and J. E. Juggins, is situated about 200 feet above Summit lake on its east side. Work done on the claims consists of surface cuts and a tunnel driven to get under these showings. The open-cuts, at an elevation of 3,850 feet, disclose a rather fine show of ore. About 30 feet south of and above the tunnel an open-cut 6 feet deep in places and about 100 feet in length uncovers the vein for that distance, running east and west; then turns at right angles and follows the vein north for over 200 feet. The vein lies in a schistose, volcanic tuff, and consists of silicified country-rock and quartz with a little calcite, heavily mineralized in places with pyrite, chalcopyrite, chalcocite, with a little galena and zinc-blende. The tunnel, at an elevation of 3,750 feet, or 100 feet under the croppings, has been driven a distance of 162 feet on a bearing of east and west, then turns to the left for 24 feet, making a total of 186 feet, which should have cut the ore-body if it went down on the strike and dip indicated on the surface. There is no sign of ore in the tunnel. It is rather surprising for one to go into the tunnel from such a strong, well-mineralized surface showing and find no trace of it, although comparatively only a few feet beneath it. I would certainly continue the tunnel east and west far enough to convince myself that a flattening of the dip of the vein was not the cause of missing it. A grab sample was taken from the broken ore on the surface, giving returns of: Gold, trace; silver, 8 oz. a ton; copper, 8 per cent.; zinc, 6.7 per cent; lead, trace.

This is an excellent surface showing, and if it could be picked up as good on the tunnel-level would make a very promising property.

Silver Star Group. This group, staked by Juggins & Jones, consists of two claims—the *Silver Star* and *Silver Star Extension*. The claims are situated on the east side of the Illiance river, opposite the property of the United Metals Company, and about a mile from the United Metals cabin, from which there is a good trail. A crosscut tunnel 42 feet long has been run to the vein from a deep gulch. The vein where encountered by the tunnel shows about an inch of galena. It was then drifted on for 14 feet, giving a greatest width of ore of 8 inches, and pinching out entirely in the face, where the walls

are badly distorted and show considerable movement. The rock formation is a clayey schist. The ore may be expected to appear again in the drift when the crushed zone is passed, and therefore the tunnel should be extended. About 40 feet south of the tunnel-mouth the vein crops in the wall of the gulch, on which about 12 feet of an open-cut has been run, showing from 2 to 6 inches of solid galena and grey-copper. The vein strikes at N. 50° W. and dips at about 45 degrees to the west.

I fail to see why the tunnel was not started on the vein and run as a drift for 42 feet instead of that amount of dead-work done in crosscutting. A sample taken from the ore in the open-cut assayed: Silver, 170 oz. a ton; lead, 25.2 per cent. This would be the shipping grade of ore, as the sample was taken of the best.

The showing is small for a company to operate, but would make a good leasing proposition for three or four men who would mine and ship the ore themselves.

Silver Cliff Group.

This group has four claims in it—*Silver Cliff No. 1*, *Silver Cliff No. 2*, *Silver Cliff No. 3*, and *Beaver*—owned by Hauber & Hallett, of Alice Arm. They are situated on the east side of the Illiance river, opposite the United Metals Company holdings, at an elevation of 3,800 feet. The showing is a small quartz vein about 8 inches wide, lying a decomposed, schistose tuff, and slightly mineralized with chalcopyrite and trace of argentite. Very little work has been done. A sample of the quartz gave: Gold, trace; silver, 6 oz. a ton; copper, 0.6 per cent. The vein is frozen tight on both walls and does not give much promise of improvement.

On the *Silver Cliff No. 1* there is a cropping, 6 feet wide, of barite carrying a small amount of chalcopyrite, and which has been opened up by an open-cut 15 feet wide, exposing a face 6 feet high. This vein has been exposed in several places above.

On *Silver Cliff No. 2* claim there is an immense outcrop, about 60 feet wide, of white, barren-looking quartz. It has been broken into in only one place, showing no mineralization and carrying no values.

PORTLAND CANAL MINING DIVISION.*

The general condition of the mining industry in this Division has been marked by a steady improvement throughout the year. Predictions of a year ago have been and are being fulfilled and new ones made for the future.

Development-work has placed one property on the shipping-list, which, I think, will become probably a large silver-gold producer within a year or two. Exploratory work during the year has been highly satisfactory on at least three properties, which give every reason for expecting them to develop into producing mines. Prospecting-work on claims held for some time, done by the owners, and which is the most important development-work of all and the best indication of mining conditions in any district, has disclosed some very fine showings of ore in all parts of the Division. Prospecting has resulted in several new "finds." There is considerable open ground yet for the prospector, and a lot more that would be open if the "claim-fiend" staked only what he could explore.

The outlook for mining for the coming year is exceptionally good, because the properties that are under development are showing up so satisfactorily that mining operators are being attracted to this district and are taking over prospects to develop. The greatest benefit this Division could receive, right now, is a good dock, located at Stewart, B.C., to meet the requirements of both the Salmon and Bear River valleys.

For convenience the Division will be subdivided into three sections, as follows: Portland Canal Mining Division—Portland Canal Section; Bear River Section; Salmon River Section.

Portland Canal Section.

Outsider Group.

This group consists of eight claims—*Elsie*, *Tunnel Fraction*, *Copper King*, *Regina*, *Hope*, *Brown*, *Summit*, and *Constance Fraction*—situated at Maple bay, which is about thirty-five miles from Stewart. This is the old Brown-Alaska property which was equipped in 1916 with an aerial tramway from the mine to the beach, where commodious ore-bunkers and a good freight-dock were built. It was operated for a couple of years, shipping several thousand tons of copper ore, averaging about 2.8 per cent. copper, to the Hadley smelter.

* Memoir 32, Dominion Geological Survey, by R. G. McConnell.

The present owners, Martin Woldson and associates, of Spokane, Wash., with Andrew Sostad in charge of operations at the property, have been operating now for over a year. During this time they have driven a working-tunnel, at an elevation of 912 feet above sea-level, a distance of about 750 feet, gaining a depth of 173 feet below the old working-tunnel from which the ore shipped was extracted. This year's work consists of 351 feet of driving on the foot-wall, with five crosscuts from it across the vein aggregating 114 feet, which work has developed an ore-shoot over 200 feet long and averaging about 16 feet in width. At the time of my examination of the property two crosscuts had been driven; the first showed the vein to be 14 feet wide of quartz mineralized with pyrrhotite and chalcopyrite, with 2 feet of it on the hanging-wall of about 5-per-cent. copper ore; the whole, judging by eye, would average approximately 2 per cent. copper. The second crosscut, 50 feet farther in the tunnel, proved the vein to be 19 feet wide of the same grade of ore. The vein strikes at N. 10° E., and dipping at from 55 to 60 degrees to the east, will give backs of approximately 200 feet to the level above, which will produce a big tonnage of milling-ore from this ore-shoot alone between these two levels.

The "West tunnel," at an elevation of 1,190 feet, 105 feet above the old tunnel and 278 feet above the present working-tunnel, crosscuts to the vein from the surface. Drifts have been run both ways on the vein, showing an ore-shoot 250 feet long, averaging between 5 and 6 feet in width. This is another ore-shoot north of the old one from which the ore was mined in early days, and now being opened up by the level below.

The old "main tunnel" was driven under this north ore-shoot on the 1,085-foot level, but apparently the ore does not extend down that distance; however, a raise will be put up from that level to tap it, for it will no doubt also produce a big tonnage of milling-ore.

At an elevation of 2,100 feet, about 900 feet above the "West tunnel," there is a very strong outcropping of the same class of ore. It has been broken into in several places and stripped along the surface for 300 feet or more, showing a width up to 30 feet and averaging between 8 and 10 feet. This is evidently another vein east of the one on which the workings are, lower down. The ore is a decomposed, honeycombed quartz on the surface, but when broken into shows the same content of pyrrhotite and chalcopyrite as the other vein.

These veins appear to be contained in a belt of sedimentary rocks, more or less altered, enclosed in the main Coast granites. The higher showing just mentioned could easily be opened up and the ore trammed down to the upper terminal of the aerial tram from the main tunnel to the bunkers on the beach. No sampling was done for the reason that a grab sample here and there would be of no use, and I had no time for a thorough systematic sampling necessary on such a property.

A very efficient small plant was installed early in the spring, consisting of a compressor building and two 9- x 8-inch straight-line Ingersoll-Rand compressors, set on separate heavy-timber foundations, and each driven by a 24-inch Pelton-Doble water-wheel. About 1,300 feet of 5-inch water-line was laid, giving a 300-foot head at the water-wheel. The compressors, discharging into a common air receiver, maintain a pressure of 107 lb. at the machine, from which two Leyner hammer-drills are operated. It has been a very satisfactory little plant for the work for which it is intended.

It is evident that, unless very favourable smelter rates can be procured for this low-grade siliceous ore, concentration will be necessary. The ore, being a straight quartz and sulphide mixture, should make an ideal flotation-feed, and I should judge the ratio of concentration would be about 10 or 12 into 1. The old equipment is in bad condition, but practically all the ironwork, tram-cables, etc., could be salvaged and used again.

There is a supply of timber for all purposes and plenty of water for milling and possibly power. The property is very advantageously situated on tide-water.

Maple Bay Group.

This group consists of the following claims: *Scottish Chief*, *Portland*, *Blue Bell*, *Maple Leaf*, *Copper Queen*, *Lizzie*, *Scotland-for-Ever Fraction*, *Anaconda*, *Princess Alexandria*, *Thistle*, *Comstock*, *Princess May*, *Maple Bay Fraction*, *Comstock Fraction*, *Princess Royal Fraction*, *Princess Victoria*, *Princess Alice*, *Princess Maud*, *Eagle*, *May Queen*, *Star*, and *Rose*. They are situated at Maple bay, on Portland canal, about thirty-five miles from Stewart, adjoining the *Outsider* group on the south. The Granby Consolidated Company, which had a bond on this group, put in a power plant on the beach and a tramway from the beach to the tunnel, which it drove on the *Star* claim. This

work (exact amount not available) is done on the extension of the *Outsider* group vein, but, failing to develop a satisfactory ore-shoot, the option was thrown up and the plant dismantled.

Owing to the lateness of the season when I examined this section, I was unable to get over the higher showings on this property. However, from reliable maps and private reports I have gained some information which may be of interest. On the *Eagle* and *May Queen* claims a vein has been traced the full length of the claims, showing a width up to 45 feet. At an elevation of 2,300 feet a tunnel was driven 25 feet across the ore-body and a drift of 60 feet run on a strip of country-rock enclosed in the vein. Six samples from the 25-foot crosscut assayed from 1 to 3.5 per cent. copper. At the end line of the *May Queen* and *Eagle* there is 6½ feet of massive sulphides; 3 feet 3 inches from the foot-wall assaying 7.28 per cent. copper, and 3 feet 3 inches on the hanging-wall assaying 4.6 per cent. copper. About 300 feet farther along, at an elevation of 3,200 feet, the outcrop is 12 feet wide, averaging 2.7 per cent. copper. Five hundred feet farther along is an exposure 6 feet in width of solid sulphides.

At the intersection of the *Princess Alexandria* and the *Princess May* claims, at an elevation of 2,400 feet, there is an outcropping traced for 2,000 feet by open-cuts, and can be followed on the surface another 1,500 feet. A cross-vein from the *Anaconda* claim connects with this at an elevation of about 3,000 feet. The *Princess* vein will average lower grade than the *Eagle* vein. On the *Anaconda* there are two veins, the one mentioned as joining the *Princess* vein and a small, irregular, parallel one. The former averages about 2.4 per cent. copper for a width of 8½ feet.

On the *Thistle* claim another vein can be traced for 1,000 feet. A cut across the south end exposes it for a width of 17 feet; an average assay of three samples across it gave 3.4 per cent. copper. In the middle of this vein there is 5 feet 8 inches of ore assaying 8.2 per cent. copper.

On the *Blue Bell* claim two veins are exposed, striking N. 10° E. and dipping 45 degrees to the East. These extend along the face of a steep cliff and are from 1 to 3 feet wide, showing some good-grade copper ore. A tunnel was driven under them for a length of 360 feet, but failed to pick up the ore at depth.

Taking these showings altogether, their persistence, and average values in copper—there are no gold or silver values—there are good reasons to believe that further exploration will develop not only a tonnage of milling-grade ore, but probably shoots of shipping-ore. The property is most conveniently situated on tide-water. I expect to make an examination of these showings as early in the spring as conditions will permit.

Swamp Point. At Swamp point the Granby Consolidated Company has several claims from which they obtain the limestone for fluxing purposes. The property is well equipped and employs about thirty men the year round, under the superintendence of Roy Price. The production is about 250 tons of lime rock a day, which is hauled to the smelter in company scows.

Guggenheim Group. This group, consisting of eight claims—*John D.*, *Guggenheim*, *J. P. Morgan*, *Danny*, *Lookout*, *Summit*, *Charlotte*, and *Hillside*—is owned by the Georgia River Mining Company, whose registered office is in Duncan, B.C., and under the management of C. H. Dickie. Referring to the Minister of Mines' Reports for 1914, 1916, and 1917, there is no need of going into details of the property, and note will be made of only the work done and results obtained during the year.

The winze, which was down 35 feet, was continued to a depth of 42 feet. In the sinking of this winze the ore was left on the west side of it at about 22 feet from the top, following a small stringer from the east side to the bottom at 35 feet. This year the ore was again broken into and followed for 7 feet down. It was found to be 2 feet in width, about half quartz, and the balance the typical pyrrhotite of the property, a sample of it assaying 2.28 oz. gold and 3.74 oz. silver a ton. The *Bulletin* tunnel was extended 20 feet and a crosscut driven from the end of it 35 feet west toward the "Big Showing." There is no ore showing in the face of the tunnel nor in the crosscut.

The Department of Mines assisted in extending the trail up the Georgia river towards the property. The repairs and improvements on the old portion of the trail were heavier than anticipated; consequently the amount provided for new trail was not sufficient to complete it through to the mine, although the most difficult portion is over. There are about three miles yet to build.

More settled conditions will no doubt permit of the equipment and further development of this property for production.

The Marmot river has had very little mining activity of any kind and was not examined this year. I am informed that there are a couple of properties that might get out a small tonnage for shipment if trail conditions were improved.

BEAR RIVER SECTION.*

Molly Group. This group of four claims—*Somme Fraction, Molly Fraction, Gulch Fraction,* and *Molly B.*—is situated on the east side of Bear river about half a mile from tide-water, just across the river from the town of Stewart. The claims are owned by J. W. Stewart, of Victoria, B.C., and associates. Part of the claims are on Indian reserve, but I believe arrangements have been made whereby the Indian owners are to be paid a 10-per-cent. royalty on the net proceeds of ore mined from the reserve.

The rock formation appears to be an altered greenstone, and in places a brownish, schistose-appearing rock resembling tuff. It is very close to the main granite range, and the mountain-side along here is full of isolated tongues of granite intruding through the general greenstone formation.

The showing consists of a vein, running N. 60° E. and dipping 60 degrees to the north, of about 10 feet in width, of quartz with which are associated garnetiferous silicates, epidote, and enclosures of a dark-green rock, probably hornblende, the whole suggesting a vein of contact metamorphic origin. It has been exposed by an open-cut at the edge of the river and a stripping of about 20 feet above to another small cut. The prominent mineralization is pyrite, with scattered chalcopyrite and molybdenite, the latter mainly contained in the greenish hornblendic rock, although it is more or less disseminated throughout the whole vein. It is a strong well-defined-looking ledge and should prove continuous, though it has not been traced any distance owing to the heavy overburden on the hill above, nor has sufficient work been done to form any opinion regarding it.

Without sampling, I would size the vein up to average about 2 per cent. molybdenite. There is about 5 tons piled on the dump, a sample of which was sent to Seattle dealers, who gave returns of 9 per cent. MoS_2, and for which a flat rate was offered of $117 a ton f.o.b. Stewart dock. On the whole, it is a good showing, well located for transportation, and having all the natural advantages of timber, water, and of being easily developed by tunnels. It is worth investigating for molybdenum, and, I understand, can be bought on reasonable terms.

Prince John Group. This group consists of nine claims—*Prince John No. 1* to *No. 9*, inclusive—owned by James Nesbitt and Andy Archie, of Stewart, B.C. The claims are situated on the west bank of Bear river about five miles above Stewart, on the opposite side of the river from the Portland Canal Short Line Railway. The work on the property consists of surface cuts, a crosscut tunnel, and some diamond-drilling done by the Granby Company, which had the property under option last winter. The tunnel, at an elevation of 2,350 feet, shows a cross-section as follows: From the mouth of the tunnel there is 30 feet of greenstone-schists to the ore-body; then 45 feet of schistose, slates, and argillites mineralized with chalcopyrite, disseminated throughout the slates and in narrow bands, veinlets, and small lenticular bunches lying in the bedding-planes and cross-fractures; beyond the mineralized zone is an acidic dyke 45 feet wide; then a width of 65 feet of slate and argillites to the face of the tunnel, slightly mineralized with chalcopyrite, but not of sufficient value for milling purposes, although further work by way of drifting should be done in this portion to further prove the grade of the ore. In the 45 feet of "vein" there are portions of a few feet in several places showing good copper ore, while the balance is more sparingly mineralized. Reliable samples across the ore-zone have given an average of 2 per cent. copper and $1 in gold and silver a ton.

The diamond-drilling by the Granby Company, I am told, was so unsatisfactory owing to the soft slips and fractures in the formation that it was abandoned, and the tunnel driven through the dyke and the portion beyond. The open-cuts on the surface expose the same conditions as shown in the tunnel. On account of the snow I was unable to get over the surface to any extent. Some free gold has been found farther south on the claims in small quartz veins.

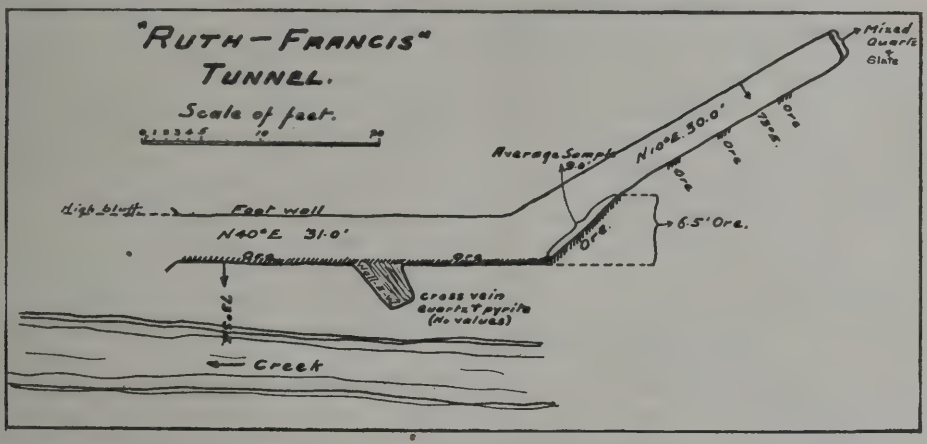
The property is very advantageously situated from a mining and transportation standpoint, and, judging from the general appearance of all the showings, I think that insufficient explora-

* Memoir 32, Dominion Geological Survey, by R. G. McConnell.

tion has been done to be conclusive as to the merits of the property. While it might not meet the requirements of the Granby Company, the ore is so well adapted to flotation that it might become a profitable concentrating enterprise.

Mayflower Group. This group, consisting of four claims—*Mayflower*, *Trade Dollar*, *Kitty*, and *Blaine*—owned by H. P. Gibson, of Stewart, is situated about 1,000 feet above the Bear river on the east side, between Glacier and Bitter creeks. Along a small creek three or four veins of quartz and argillite, carrying pyrite, a little chalcopyrite, blende, and galena, are exposed in an argillite country-rock, termed the "Bitter Creek formation" by McConnell. A little work has been done by way of stripping and open-cutting, and a crosscut tunnel of 20 feet, with a further drift of 6 feet on one of the veins exposed on the surface. The drift will have to be advanced about 40 feet to get under the surface showing, which consists of a vein, about 4 feet wide, of quartz and argillite. This is a fair showing and deserving of the continuation of the drift to get under it, further work depending on the results obtained. A few tons of ore, running about $60 a ton in gold values, was taken from a small vein lower down the hill, showing that there are good values in the vein. There is a good foot-trail from the railroad to the property and there would be no difficulty in getting ore down.

Ruth and Francis Group. This group is owned by Nesbitt & Archie, who also own the *Prince John* group. There are four claims in this group—*Ruth*, *Francis*, *Copper King*, and *Little Johnny*—situated on the North fork of Glacier creek, four miles from the railway. There is a fair pack-trail to the property from the Bear River valley, with the exception of a few bad places that could be repaired in the event of steady packing. There is a small cabin on the property at an elevation of 3,440 feet and an abundance of timber and water for all purposes.



On the *Ruth* claim a tunnel (*see* sketch) has been driven 61 feet, following the hanging-wall, which strikes N. 40° E. for 31 feet; then turns to the left on a bearing of N. 10° E. for 30 feet to the face, following the foot-wall. This portion of the vein is a mixture of pyritized quartz and slate, carrying no values. At a point 16 feet in the tunnel a cross-vein of quartz and slate breaks from the main vein on a strike of due east and west, and on which a short drift has been run, showing no values. At 31 feet in the tunnel, where it turns to the left, there is a face of solid antimonial lead on the right-hand side, across which for a width of 6½ feet (or 9 feet diagonally) a chipped sample was taken, assaying: Gold, 40 cents; silver, 31.6 oz. a ton; lead, 15 per cent.; zinc, 18 per cent.; antimony, 8.3 per cent. Shots were put into this ore-body at intervals to the face of the tunnel, breaking into the antimonial lead in each case. The ore has been broken into for only a foot or two in the face where it was first encountered, and it would be interesting to know whether the hanging-wall goes ahead at the same strike as shown so far with the ore following it, or whether there is a swing in the hanging-wall conforming with the turn in the foot-wall to N. 10° E. There is a small seam of ore from the mouth of the tunnel on the hanging-wall all the way. At no place on the surface, so far as can be seen, is there more than 6 inches of solid ore.

About 200 feet farther south and 60 feet vertically lower another tunnel has been driven 25 feet on the same vein, here showing a width of 6 feet of mixed quartz and slate, in which there is a little pyrite and galena.

About 25 feet south of the mouth of the main tunnel another cross-vein runs N. 60° W., lying on the south side of the 2-foot basic dyke. A small open-cut has been put in on this, showing the typical quartz and slate filling of 4 feet in width, in which are small values.

About 15 feet east of the main vein at the mouth of the upper tunnel another vein crops in the bed of the creek, showing a width of 6 feet of quartz and slate running parallel with the opened-up vein. No work has been done on it and the values are not known. The country-rock is, for the greater part, blocky argillites and slates, though there are areas showing a fine slaty cleavage.

There is a vein of copper ore on the *Copper King* claim, consisting of quartz and calcite carrying chalcopyrite, from which some very good samples of ore were shown. It has been prospected by an open-cut which I was unable to see on account of the snow. A tunnel has been driven 40 feet toward it and will require a further 30 feet to get under the cropping. The property gives a very favourable impression, and, I think, merits pretty thorough exploration.

Copper King Group. This group consists of four claims—*Copper King*, *Copper King Fraction*, *Copper King No. 2*, and *Copper King No. 3*—and is owned by G. M. Brown. It lies east of and adjoining the *Ruth and Francis* group. I am informed that the showing is much the same as that on the *Copper King*, of the *Ruth and Francis* group. The work done consists of open-cutting, which I was unable to examine. The vein is said to be about 10 feet wide, heavily pyritized in places, and to carry up to $10 a ton in gold.

Sunshine Group. This group, consisting of two claims—*Sunshine* and *Sunshine No. 1*—belongs to Fred. Young and Godfrey Anderson, and is situated beyond the *Copper King* group, on the main trail. The owners mined from the surface and sorted out about 3 tons of ore during the summer, a sample of which was sent to the smelter, and assayed: Silver, 349.4 oz. a ton; lead, 17.1 per cent.; zinc, 27.1 per cent. It was not shipped because, for some reason, the smelters refused to accept that grade of silver ore containing such a high percentage of zinc.

Lakeview Group. This group of four claims—*Lakeview No. 1*, *Lakeview No. 2*, *Lakeview No. 3*, and *Silver Bell Fraction*—is situated on the North fork of Glacier creek, on the *Ruth-Francis* trail, about two miles and a half from the railway. The claims are owned by James McKay and Charles Bibeau, who have done a large amount of exploration work on them. There is a good cabin near the workings at an elevation of 2,100 feet. A few tons of high-grade silver ore has been shipped each year by the owners for several years.

The vein, which strikes about east and west and dips 50 degrees to the south, can be traced for several hundred feet on the surface. At one of the croppings an open crosscut was run for 80 feet, obtaining a depth of about 12 feet on the vein. A drift was run 28 feet on the vein from the end of the crosscut, exposing a small rib of the high-grade silver ore sorted and shipped. The vein where cut by the open-cut shows a width of 9 feet, of which 4 feet on the foot-wall is principally quartz with some pyrite; the balance, 5 feet, is a very heavily pyritized quartz and slate. On the hanging-wall is a diabasic dyke about 2 feet wide, outside of which is a quartz-stringered slate for a foot or two, carrying pyrite. The heavily pyritized portion of the vein would concentrate about 3 into 1 and the quartz portion probably 10 or 12 into 1.

As stated in last year's Report, the property was then under bond to a local syndicate, who were driving a crosscut tunnel 100 feet vertically lower to undercut the surface exposure in the open-cut. The tunnel was driven 250 feet, which should have cut the vein, but, failing to do so, the option was thrown up.

The property is therefore now in fine shape for further exploratory work, such as sinking on the vein to learn its dip and continuity at depth. When the irregularity is located, for there must be some reason for the non-extension of the vein downward, work in the lower tunnel can then be regulated accordingly. High gold values are found in the quartz and pyrite and also in the more solid pyrites. It is a property that I would have no hesitation in recommending for further prospecting, believing that by concentrating the ore it can be made profitable.

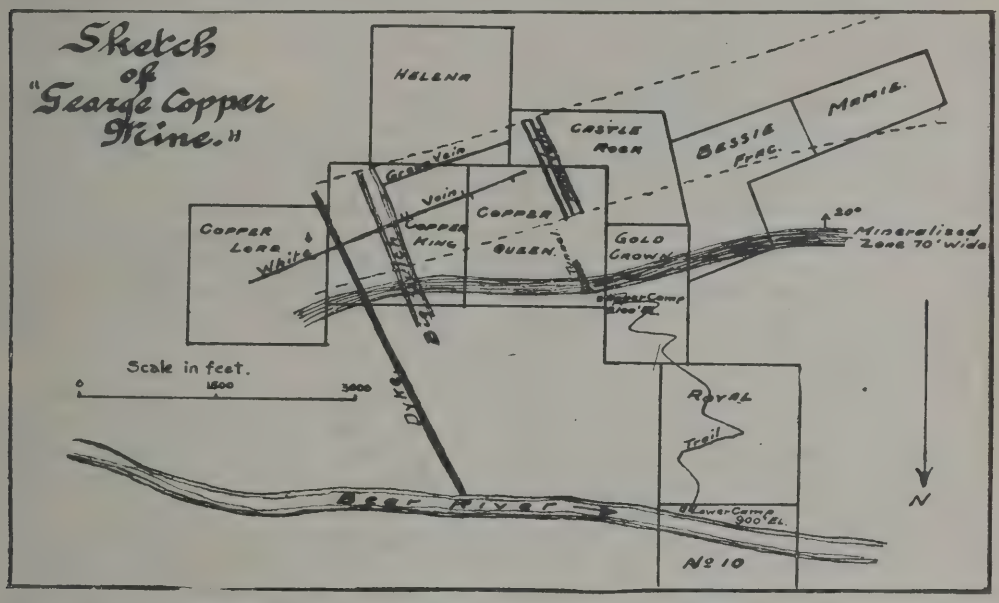
George Copper Mines.

(*See* Minister of Mines' Report for 1917.) This property, situated on the south side of Bear river, six miles up from the terminus of the Portland Canal Short Line Railway at the *Red Cliff* mine, is owned by W. B. George, of Stewart, and R. George, of Vancouver. The group is comprised of ten claims—*Mamie*, *Bessie*, *Gold Crown*, *Copper King*, *Copper Queen*, *Copper Lord*, *Castle Rock*, *Helena*, *Royal*, and *Water Fall*. (*See* sketch of claims.)

At the foot of the mountain on which the claims are located Bear River valley has an elevation of 900 feet at the cabin. The upper camp on the claims is 2,100 feet elevation, to which there is a steep foot-trail. An appropriation was recommended by me and granted by the Mines Department to aid in the construction of a pack-trail from the cabin to the upper camp. Conditions this summer, however, were such that the owners could not put in the trail, but I am assured they will be in a position to do so the coming summer.

This year the tunnel was extended 10 feet, making a total length of 115 feet, into the big mineralized zone, showing a little improvement in its mineral contents.

On the "Blue vein" no work was done this year. It is comprised of three veins contained in a 50-foot mineralized belt, traceable for 1,000 feet or more, the veins aggregating 10 feet of ore, averaging: Gold, $4; silver, 30 cents a ton; copper, 3 per cent.



The "White vein," traceable for 2,000 feet on the surface, was opened up this year in two more places by open-cuts, making five cuts or exposures on this vein. Just west of the "big gulch" is a showing of quartz and chalcopyrite on the hanging-wall 18 inches wide, assaying: Gold, trace; silver, 0.4 oz. a ton; copper, 8.8 per cent.; the remaining 36 inches in the foot-wall assaying: Gold, $1.20; silver, 0.4 oz. a ton; copper, 14 per cent. About 30 feet west of this it was exposed for a width of 9 feet 6 inches this year, of which 4 feet is magnetite carrying chalcopyrite (no assays), 3 feet of fairly solid chalcopyrite, and 2 feet 6 inches of quartz and chalcopyrite; the last 5 feet 6 inches is estimated by W. B. George to average from 8 to 10 per cent. in copper. Another sample, about 350 feet west of the last, of 40 inches on the hanging-wall gave: Gold, trace; silver, 0.4 oz. a ton; copper, 1.6 per cent. About 10 feet farther west a sample across 36 inches on the foot-wall assayed: Gold, trace; silver, 0.4 oz. a ton; copper, 16 per cent. On this same vein, 200 feet east of the "Blue vein," a crosscut this year showed it to be 15 feet wide, of mixed ore, stringers of ore in country-rock, and it is thought that the full width has not yet been exposed.

No work was done on the "Green vein," which is about 50 feet south of and parallel to the "White vein." A sample last year across 5 feet gave assays of $2 in gold and silver and 5 per cent. in copper.

The property appears to improve steadily with exploration, and with improved conditions should receive the more extensive investigation it is entitled to.

SALMON RIVER SECTION.*

This section continues to improve with exploration, and with one property shipping high-grade ore this winter and several others well on the way towards making producing mines, it may be considered as fairly well established and the steady growth of mining activities a certainty.

There is urgent need at the present time for adequate shipping facilities in the way of a dock, and the mining condition of this and the Bear River section should be sufficient guarantee for the future to justify the Dominion Government in building one. Then, with a good road from the upper Salmon river to tide-water at Hyder and a good road from there to the dock, this section would have good facilities for developing and mining on any scale. The upper Salmon river—that is, that portion in British Columbia above the Alaska-British Columbia boundary-line—is now reached from Stewart, at the head of Portland canal, by a trail along the beach from the old dock to Hyder, at the mouth of Salmon river, and from there up the valley by the Government trail.

There are at present hotel accommodations at Hyder, and I understand that the hotel at Stewart will be open for the coming year. Stewart is now reached by launch every week from Prince Rupert, but it is altogether likely that one of the larger boats will take the run in the spring.

A road was built last summer from Hyder to the *Bush* mine, sixteen miles up the valley. At 11-Mile there is a road-house run by "Dad" Davis, where a first-class bed can be had and A1 meals, for "Dad" is a good gardener and "some" cook. From this central point a big area of this section can be gone over. From 11-Mile the road is followed for about three miles, from which point a good horse-trail continues to the head of Salmon river and Cascade creek.

The most widely distributed rock formation in this section is greenstone, termed by McConnell the "Bear River formation," which borders on the north-eastern side of the Coast granites, practically all of which lie on the Alaska side until the Salmon River glacier is reached. The greenstones are badly sheared to a greenish schist in which are altered and silicified zones containing the majority of the known ore-bodies of this section.

The following properties were examined this year:—

International Group.

This group, consisting of eight claims—*Cabin, Group, Lucky, Daly, Grub Stake, Grub, Boundary,* and *International*—is owned by Pat Daly and associates. The claims are situated about two miles north-east of 11-Mile and just on the British Columbia side of the boundary-line. There is a good trail to the property branching off the old trail a few hundred feet above the boundary-line.

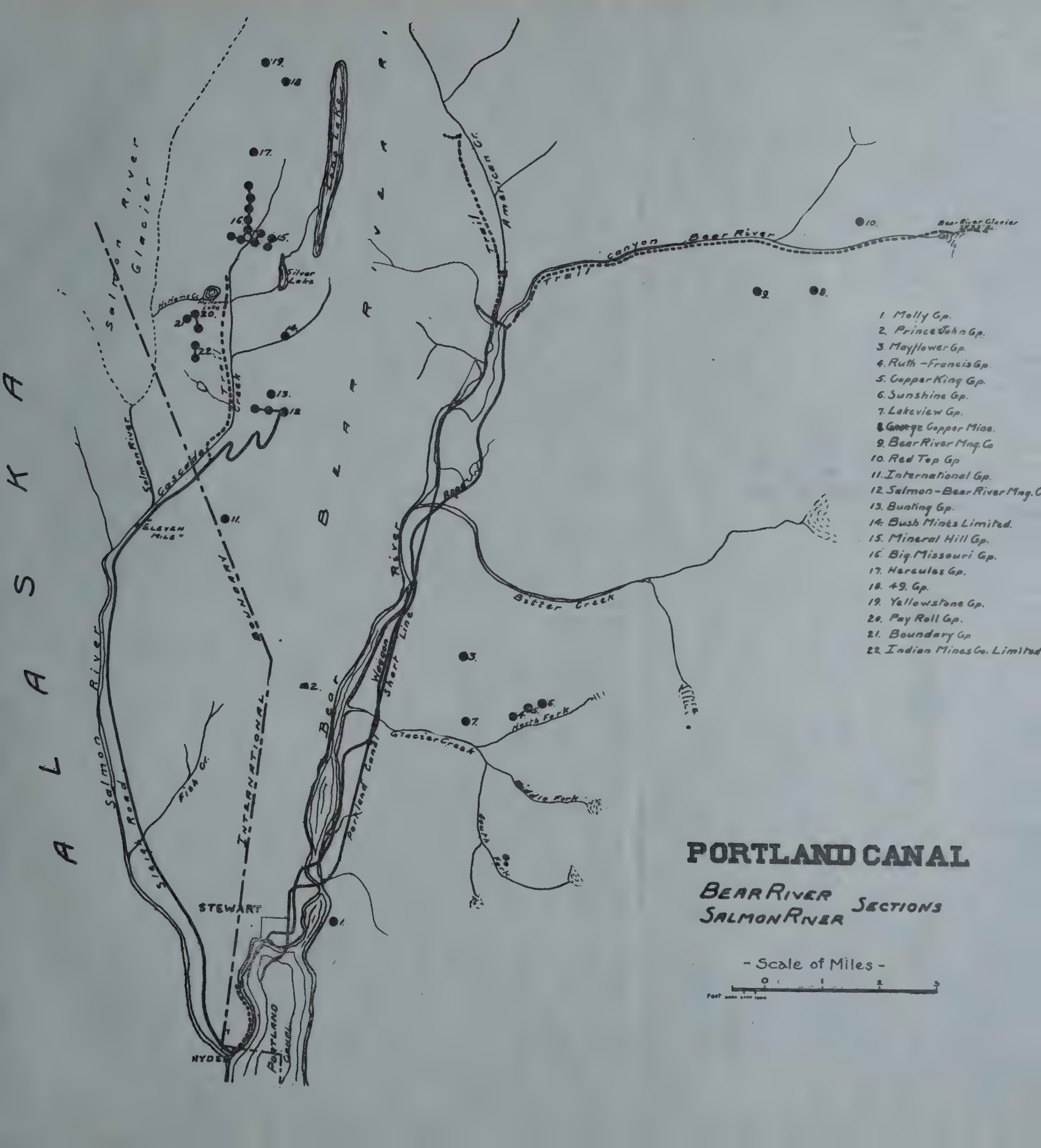
The showing consists of a band or vein of silicified greenstone, between 8 and 10 feet wide, lying in a dark-green schist. The vein dips 63 degrees to the west and has a strike of N. 20° E. Throughout the vein are small veins of pure quartz running in all directions, the whole filling mineralized with iron pyrites. As a general rule, in these veins the best values are carried in the purer quartz portions. This vein is cut by a small creek showing a face about 12 feet high on each side, and on the north side open-cuts traced the vein for some distance up the hill. Where exposed the vein will carry about $3 or $4 a ton unless silver sulphides are showing. The vein-filling is exactly the same as the *Bush* vein, and there is, of course, the possibility that shoots of high-grade ore will occur in this as in the *Bush* vein.

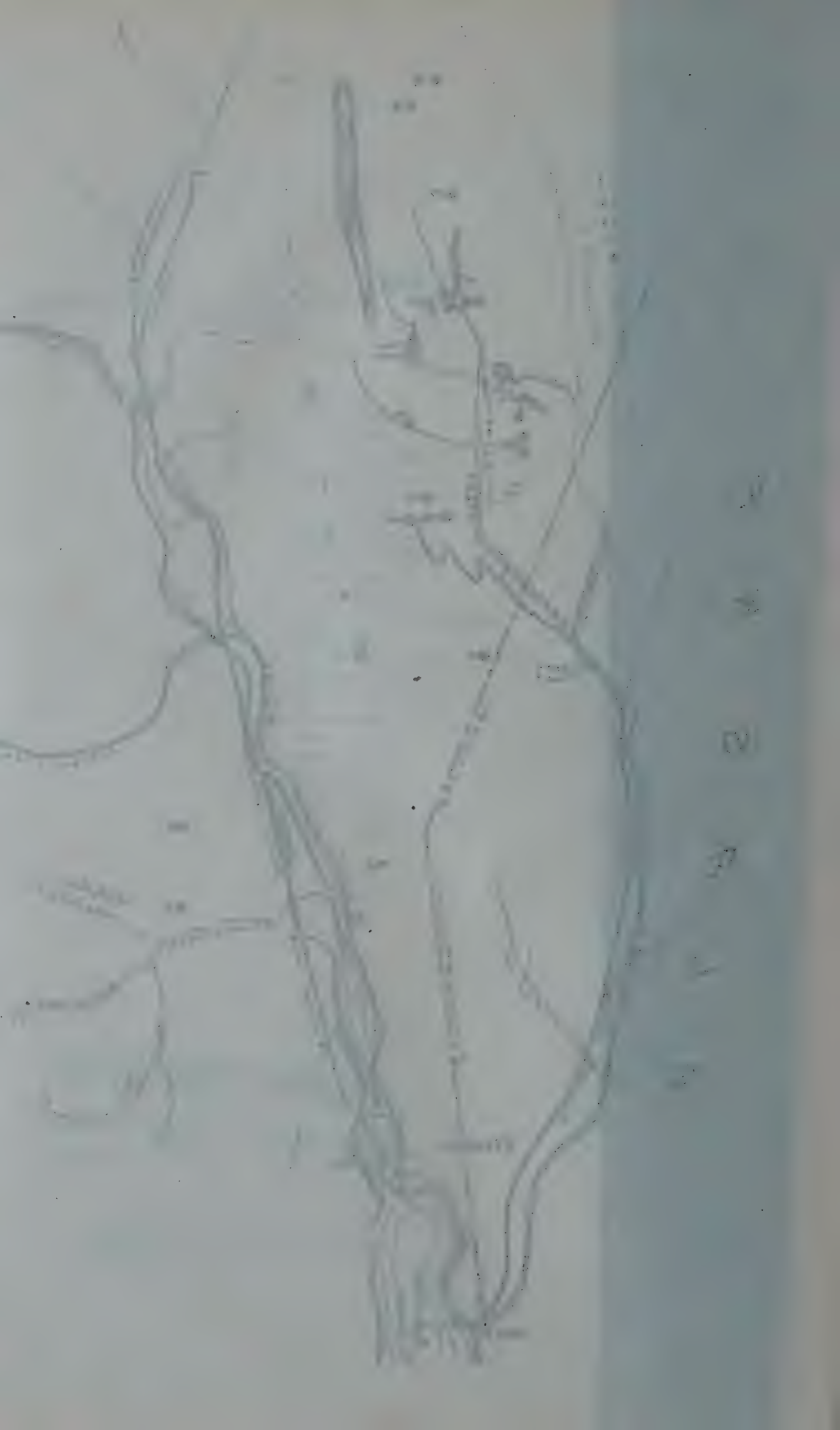
The showing is strong and well defined and there is no reason why it should not persist in length and depth. The property is well located and well supplied with necessary timber and water. Only exploration can prove whether or not there are deposits of commercial ore.

†Salmon-Bear River Mining Co.

This company's holdings consist of eight mineral claims, as follows: *Essington, Rupert, Simpson, Pictou, Cascade Falls No. 4, Cascade Falls No. 8, Daly,* and *Pat Fraction,* probably better known as the *Bush* property. The claims are located on the east side of Cascade creek, about sixteen miles from tide-water. They are all Crown-granted. During the year a winter road was built from the beach to the property and is being utilized this winter for hauling out ore. The management estimates that 1,000 tons or more of $200 a ton ore can be shipped this winter. The road cost approxi-

* Memoir 32, by R. G. McConnell, Dominion Geological Survey.
† *See* 1917 Report.


ALASKA
Salmon River Glacier
Silver Lake
Hyder Creek
Salmon River
Eleven Mile
Salmon River Road
International Boundary
Fish Cr.
Bear River
Portland Canal
Short Line
Bear River Trail
Canyon
Bear River Glacier
Bitter Creek
North Fork
Glacier Creek
Middle Fork
South Fork
STEWART
HYDER
Portland Canal
1. Molly Gp.
2. Prince John Gp.
3. Mayflower Gp.
4. Ruth - Francis Gp.
5. Copper King Gp.
6. Sunshine Gp.
7. Lakeview Gp.
8. George Copper Mine.
9. Bear River Mng. Co
10. Red Top Gp
11. International Gp.
12. Salmon-Bear River Mng. C
13. Bunting Gp.
14. Bush Mines Limited.
15. Mineral Hill Gp.
16. Big Missouri Gp.
17. Hercules Gp.
18. 49 Gp.
19. Yellowstone Gp.
20. Pay Roll Gp.
21. Boundary Gp
22. Indian Mines Co. Limited
PORTLAND CANAL
BEAR RIVER SECTIONS
SALMON RIVER
- Scale of Miles -



mately $45,000, of which a portion was appropriated by the Mines Department under the "Mineral Survey and Development Act." It is estimated that to convert it into a serviceable wagon-road will cost about an equal amount. In conjunction with the road a half-way house and barns were erected at 9-Mile for the accommodation of drivers and teams. Fourteen horses, with all necessary equipment, were taken in this fall, it being the intention to work three 4-horse teams on the level haul from 11-Mile to the beach, and several single teams on the hill from the mine to 11-Mile. Latest information is that several hundred tons has just been shipped by the steamer "Prince John" to Tacoma, Wash.

Three distinct veins were cut along the road-grade, the most southerly being the one on which all the development has been done. The other two, so far as known, do not show the high-grade ore of the other zone. There has been comparatively little work done underground this year because of lack of labour and the concentration on the sleigh-road construction. Since the last report the upper tunnel has been extended to a total length of 460 feet, about 130 feet for the year. At 330 feet from the portal a barren strip was encountered and cut through in 45 feet; from there to the face, a distance of 85 feet, the average values for the full width of the drift are phenomenal. The present face shows 2 feet of bonanza ore, and the balance, 3½ feet, is very high grade. The face is about 200 feet below the surface, and should this shoot continue through to the surface, persisting in length, width, and values, an estimation of its gross value is somewhat staggering. The main crosscut (No. 3) in this tunnel has been extended to 90 feet in length without encountering the wall. The average value of from $50 to $60 a ton has held all the way.

The appreciation of the importance of this property by mining men is beginning to be shown in the renewed interest in other properties in this section. With the reorganization of the company, no doubt progressive plans will be carried out which will place it as one of the leading producers of the Province.

Bunting Group. This group, consisting of eight claims, lies west of the Salmon-Bear River Mining Company's ground, and probably contains the extension of the veins. No examination of the property was made by me. It is said that this group was under option to R. K. Neill and associates.

Bush Mines. The Bush Mines, Limited, holdings consist of six claims—*Leslie*, *Leslie M.*, *Leslie No. 2*, *Leslie No. 5*, *Leslie No. 6*, and *Mahood*—situated about half a mile above the forks of Cascade and Cooper creeks and about a mile north of the Salmon-Bear River property. Unfortunately, I was unable to find the property when in this section last fall without any one who knew its location.

A company has been organized by the owner, O. Bush, with a capitalization of $1,000,000. Stock is being offered to the public at 20 cents a share under the statement that "the vein appears to be a continuation of the same vein now being worked by R. K. Neill on the Salmon-Bear River property." In this case "appearances" are decidedly deceptive, as the Salmon-Bear River vein has a strike of N. 80° E., and therefore could not, without undergoing probably fatal contortions, get near the showing of the Bush Mines, Limited.

Mineral Hill Group. This group consists of four claims—the *Joker*, *Mystery Fraction*, *Mineral Hill*, and *Midas*—situated east of and adjoining the *Laura* and *E Pluribus* claims of the *Big Missouri* group and about twenty miles from tide-water. The claims were owned by Bob Martin and Dr. Carter and are now under option to Welsh, Fetter, Carlton, and associates, of Seattle. They have carried on active exploratory work since early in the spring and will continue all winter.

The property, under the able superintendence of Al. Harris, has had a large amount of work done on it; comfortable camp buildings have been erected at an elevation of 2,650 feet, the lumber being packed in on horses from the beach; numerous open-cuts have been put in on the croppings and a tunnel is being driven. Some very high-grade ore has been exposed on the surface, and the tunnel is for the purpose of obtaining depth under these. At the time I was on the property, about the middle of October, 219 feet of tunnel had been driven through an altered, pyritized greenstone, crossing several small quartz veins carrying values up to $12 a ton. A crosscut was started north from the face of this tunnel and has encountered, it is said, some fair ore. Also the tunnel has since been extended with very satisfactory results. From all indications there is every reason to believe that this property will develop into an important producer of high-grade silver ore.

Big Missouri Group.

This group is comprised of sixteen full claims and four fractions, owned by Dan and Andrew Lindeborg and the Stevenson and Proudfoot estates. The claims are situated twenty miles from tide-water, east of the Salmon River glacier, and are reached by a good horse-trail from the Salmon-Bear River road. The property has been described in several of the Minister of Mines' Reports (1917), and as nothing new has developed on the ore-bodies reported on I will not refer to them here. The new work done this year on an entirely new ore-body has given the property a different standing altogether, for while the old workings exposed an immense body of low-grade complex ore, the new work referred to has disclosed extensive bodies of high-grade silver ore.

The work consists of fifteen or more open-cuts on the *E Pluribus* claim adjoining the *Mystery Fraction* and the *Mineral Hill* claim of the *Mineral Hill* group, which have demonstrated the continuation of the high-grade ore-shoots on the *E Pluribus* ground. These cuts are from 6 to 40 feet in length, and I am reliably informed that the ore exposed contains in places silver and gold values of over $100 a ton for a width of 20 feet. I did not attempt to sample these cuts, but I know from the appearance of the ore that the majority of them show a milling-grade ore at least, and several of them high-grade ore. A sample taken across 10 feet of good-looking ore in one cut gave assays of 115.6 oz. silver a ton.

The property is under option to D. D. Mann, who plans to commence operations on a comprehensive scale as soon in the spring as conditions will permit. I am reliably informed that diamond-drilling will be used for exploratory work.

Should this portion of the property develop satisfactorily, the immense low-grade ore-bodies will doubtless be exhaustively examined and experimented with until a successful process of concentration is devised. The success of this property will mean the immediate success of this whole upper Salmon River valley.

Yellowstone Group.

This group of three claims—*Yellowstone, Butte,* and *Old Timer*—owned by Bill Murphy and the Stevenson estate, is situated north of the Hercules Mining Company's holdings, which adjoin the *Big Missouri* ground on the north. The required assessment-work was done for the year, showing up some of the best grade of ore yet found.

Hercules.

The Hercules Mining Company claims are north of and adjoining the *Big Missouri* and are crown-granted. No work has been done for several years.

49 Group.

This group has two claims—the *Oxidental* and *49*—situated east of the *Yellowstone* group. The claims are owned by the Lindeborg Bros., who did considerable work on them this year. The old showings are on the extension of the *Yellowstone* vein. Several open-cuts were put in higher up the hill from the old cut, exposing two new veins. One, south of the main vein, was shown to be 2 feet wide, assaying 0.04 oz. gold and 72.6 oz. silver a ton; the other, a 10-foot vein, giving values of $1.20 in gold and 6 oz. in silver a ton. Another cut south-west of the old one exposed a vein 20 feet wide of broken-up quartz, from which a sample of the best-looking ore gave $6.40 gold and 29.8 oz. silver a ton.

The old cut, which had been exposed for a width of 20 feet, of which 8 feet is good ore and the whole averaging $3.20 in gold and 19.0 oz. silver a ton, was extended south for 6½ feet on the south side of a 25-foot dyke which apparently lies in the vein. The average assay of the 6½ feet gave 80 cents gold and 65.6 oz. silver a ton. The values in the veins on this group are uniformly good wherever opened up, and, everything considered, it is a very promising property.

The extension of the road from the Salmon-Bear River road to the *Big Missouri* is of vital importance to all these properties north of the *Big Missouri* group.

Pay Roll Group.

This group of two claims—*Pay Roll No. 3* and *Pay Roll No. 4*—owned by W. Murphy, of Stewart, B.C., lies south of the *Big Missouri* group on the Missouri ridge, which extends north from the junction of the Salmon river and Cascade creek. The showing is a quartz vein, carrying pyrite and galena, opened up by several cuts and a crosscut tunnel on the north end of the vein, at the edge of the gulch formed by No Name creek. The vein is traced on the surface for 1,000 feet or more. A sample across 2 feet in an open-cut just south of the tunnel gave 18 per cent. lead and 4.7 oz. silver a ton. The vein strikes N. 55° W. and dips 53 degrees to the east. The tunnel has been driven 25 feet,

crosscutting the vein, which is of mixed ore about 12 feet wide, with 2 feet on the hanging-wall of good-looking ore. The foot-wall is a broken-up slaty rock and the hanging-wall has the appearance of an acidic dyke. It is a strong vein and gives promise of developing a tonnage of concentrating-ore. A few hundred feet south of the tunnel a cross-vein shows considerable chalcopyrite.

Boundary Group. This group of four claims—*Boundary No. 1*, *Boundary No. 2*, *Boundary No. 4*, and *Missing Link Fraction*—belonging to D. L. McIntominey, of Anyox, B.C., lies west of the *Pay Roll* group. The claims are Crown-granted and have had no work for several years.

Indian Mines. The Indian Mines Company, Limited, owns four Crown-granted claims—*Portland No. 1*, *Portland No. 2*, *Big Dick*, and *Fritz*—situated on the Cascade slope of the Missouri ridge. The Government trail to the *Big Missouri* runs about 1,000 feet below the cabin, and a branch trail has been built by the company to the camp, which is at an elevation of 2,000 feet. The property was extensively explored a few years ago, although it has not been under operation for the past three years.

The country-rock is the prevailing greenstone formation of the section. The vein is quartz, varying in width from 10 to 20 feet, and apparently following a wide dioritic dyke intruding the greenstone-schists. It is one of the most persistent veins of the section, being traced for 2,000 feet on the property and an equal distance on the claims above. The quartz is mineralized with pyrite, galena, and blende, carrying gold and silver values. The vein has been opened up by three cuts above the upper tunnel and two tunnels driven in on it. The first two cuts going up the hill from the tunnel show little galena, the values being about $10 a ton in gold across a width of 12 feet of pyritized quartz. The third cut on the top of the ridge, about 150 feet vertically above the tunnel, is the main showing. Here the vein is exposed by a deep open-cut, showing a width of 20 feet, of which from 5 to 8 feet is solid galena bordered on both sides by pyritized quartz and silicified greenstone to the walls. An open-cut was driven from the side-hill a distance of about 20 feet, giving a face of 8 feet under the cut and showing 6 feet in width of solid ore of a mixture of blende and galena. This is a big surface showing and the vein should have been cut completely across here.

The main tunnel was driven over 400 feet on the vein to tap these surface showings. The first two shoots were drifted through, the first showing 2 or 3 feet of solid, fine-grained galena, which only came part way up in the drift; the balance of the vein is pyritized quartz. This shoot is about 35 feet long. The second shoot is shown to be pyritized quartz without galena, and will average about $10 a ton in gold. The main shoot has been encountered and driven on for about 25 feet to the face of the tunnel. Two crosscuts at the face show the mineralization to be 14 feet wide, with neither wall reached. There is about 2 feet of good-looking galena on the foot-wall side that should be drifted on. A sectional sample across the face gave $2.40 in gold, 3.5 oz. in silver, 10 per cent. lead, and 16 per cent. zinc. This is a very promising face of ore, and it is to be regretted that it was not drifted on farther.

The lower tunnel, at about 150 feet vertically lower, has been driven 60 feet on the vein, exposing from 1 to 3 feet of ore in the foot-wall. There is very little galena showing here, the values being mainly in gold.

Work on this property was discontinued when a little more development might have proven very satisfactory. It is well located for tunnel-mining and has plenty of timber and water for all purposes. There is a good camp, and a good equipment of tools, etc., and a car and rails in the upper tunnel.

STIKINE MINING DIVISION.

I am informed by H. W. Dodd, Gold Commissioner at Telegraph Creek, that mining has been practically at a standstill this year. Also that there has been very little placer-gold production, due, no doubt, to better labour conditions outside.

The total yield in placer gold will be about $1,000, the greater portion coming from Dease lake, with about $200 from the rest of the district. The Thibert Creek Mining Company did not operate this year. The Princess Hydraulic Company, of McDame creek, had only a few men working for a short time on dead-work.

In mineral, assessment only was kept up on seven claims. Acreage-tax was fully paid on eleven claims on Unuk river and on nine claims on the Iskut river. Four Crown grants were

136°
135°
134°
133°
60°
59°
Kluksha L
alton Post
Kisawa R.
Takhini R.
Primrose L
Primrose R.
Wheaton R.
West Arm
Partridge L.
Bennett L.
Minto
Lorne
Lansdowne
Carcross
Tagish
Tagish L.
Watson
Dundalk
Pennington
Pavy
Windy Arm
Little Atlin L
Atlin R.
Ball R.
Nis Bc
Blanchard R.
Stoney R.
Chilkat Kelsall L.
Pass
Duff L
Chilkat R.
Lindeman L.
2180
Long L.
Chilkoot Pass
Bernard L
Fraser
Summit L
Meadows
White Pass
2897
Log Cabin
Shallow L
Bennett
2928
Tutshi L
2170
Moose L
TAGISH LAKE
2161
Taku Arm
Graham In
Bearer L.
Fantail L
Golden Gate
Lawson Group
Bighorn Cr.
Engineer Mine
West Arm
Edgar L
Nilson L
Griffith I
Pike
Blaston I
Sloko I
Copper L
Stuck R.
Sloko L
Sloko R.
Silver Salmon R.
Nakina R.
Naku
Pike L
Kuthai L.
Taysen L
Huth L
Indian Cr.
ATLIN LAKE
2200
Fish L
Gladys R.
2915
Gladys Lake
Consolidated Cr.
Surprise L
3025
Discovery
Surprise
Trout L
Zenaeta Cr.
Graveyard Cr.
Terraun Cr.
Eva L.
Line L.
Angel L.
Llangorse L.
Bell L
Taku
Pine Cr.
Spruce Cr.
Fourth of July Cr.
Atlin
Golden Gate
Engineer Mine
Bighorn Cr.
Lawson Group
Fantail L
Bearer L.
Graham In
Taku Arm
Moose L
Tutshi L
Tagish L.
Tagish
Little Atlin L
Windy Arm
Atlin R.
Ball R.
Fish L
Indian Cr.
Consolidated Cr.
Surprise L
Discovery
Trout L
Eva L.
Line L.
Angel L.
Llangorse L.
Bell L
Taysen L
Huth L
Naku
Nakina R.
Sloko R.
Sloko L
Silver Salmon R.
Pike L
Kuthai L.
Blaston I
Sloko I
Griffith I
Pike
Copper L
Stuck R.
Nilson L
Edgar L
West Arm

issued to F. E. Bronson and associates on the *Red Bluff*, *Red Bird*, *Homestake*, and *Mermaid*, also on the Iskut river.

ATLIN MINING DIVISION.*

This Division has been comparatively quiet for the past two years because of the increasing scarcity of labour and the extreme high cost of everything pertaining to mining. There has been little or no prospecting for mineral, and, with the exception of two properties, no development-work. In the placer areas very little new ground has been prospected and work on pay-dirt is seriously handicapped by lack of labour. The placer-gold production for the year will approximate $220,000, as compared with $305,000 for last year.

My observations with reference to the remaining working-life of the creeks were that, while a few of the smaller creeks are practically exhausted, the large creeks, such as Pine and Spruce, with a number of their tributaries, have miles of unworked ground above the present workings, which has every possibility of being as rich as, if not richer than, that now being worked.

The possibilities of lode-mining are unlimited, for while there have been many locations made, I was surprised at the comparatively small amount of exploratory work done. In fact, the *Engineer* mine and the *Laverdiere* group were the only two properties being actively exploited. Considerable work has been done on the properties adjoining the *Engineer*, but relatively unimportant when contrasted with the possibilities as demonstrated by the development of the *Engineer* mine.

There is an immense area of country, practically unprospected except along the lake-shores, from the Yukon boundary south to Taku inlet and river, lying along the eastern contact of the Coast granites, and probably as favourable a section for exploration as any in British Columbia. Any ore within transportation distance of the lakes can be shipped by way of Carcross at reasonable rates. The joint freight tariff of the Pacific and Arctic Railway and Navigation Company and participating carriers quotes a rate on ore in sacks in car-lots from Atlin to Tacoma or Vancouver of $8.25 a ton in car-lots and $9.25 a ton in less than car-lots, and from Atlin to Anyox a rate of $8.50 a ton C.L. or $9.50 a ton L.C.L. From the *Engineer* mine, which would mean anywhere on Tagish lake, to Tacoma or Vancouver, a rate of $6.25 a ton C.L. or $8.25 a ton L.C.L., or to Anyox of $6.50 a ton C.L. or $8.50 a ton L.C.L. Ore-sacks are delivered to Atlin from Seattle or Vancouver for $21 a ton in car-lots or $30 a ton in less than car-lots. Miscellaneous commodities going into Atlin range from $50 to $60 a ton. The above rates on ore show that the transportation companies are giving every assistance toward developing and advancing the mining industry in this section.

South of Atlin lake to Taku inlet is an area that has had practically no prospecting. A reconnaissance trip was made by Mr. Carruthers, the District Public Works Engineer, last summer through this portion of the Atlin section, convincing him that transportation in the form of a wagon-road could be provided if the production of that area and the Atlin country warranted it. A good trail should be provided in the meantime for the benefit of the prospectors.

For the purposes of this report the Division will be subdivided as follows: Atlin Mining Division—Rainy Hollow Section; Atlin Section.

RAINY HOLLOW SECTION.†

This section of the Atlin Mining Division is accessible by way of Haines, Alaska, a port of call for the American boats, but not for Canadian coastwise steamers, which call at Juneau and Skagway. To get to Haines, unless on an American boat, it would be necessary to catch one at Juneau going north, or return from Skagway to Haines by launch.

From Haines up the Chilkat river to Wells camp at the mouth of the Klehini river, a distance of twenty-four miles, there is automobile service, the trip taking about two hours. The road is in fair condition and with some improvements would be serviceable for truck-haulage. The elevation at Wells camp is 110 feet. From Wells camp the walking was fine for the balance of the distance, thirty-four miles, to the *Maid of Erin* camp, a total distance of fifty-eight miles from Haines. Leaving Wells camp, the Chilkat river was crossed on the Government bridge, and the road, poor along the river-bottom for two miles, followed up the south side of the Klehini river to the next stopping-place at Porcupine, where accommodations

* Memoir 37, by D. D. Cairnes, Dominion Geological Survey Branch.
† Dominion Geological Survey, Summary Report, 1913, page 29.

could be had, a distance of fourteen miles. Autos could make the run to this point if the two miles across the river from Wells camp were repaired. The road-grade is generally good, there being one hill of 16 per cent. grade at eight miles from Wells. From Porcupine to the boundary-line at Pleasant camp is seven miles. The road on the south side of the Klehini was washed out; consequently the river was forded about three miles from Porcupine and the old Dalton road followed from there to Pleasant camp. Elevation at the boundary is 900 feet. Good accommodation at Pleasant camp. From here to the end of the wagon-road at Rainy Hollow is ten miles and a further three miles and a half of new road to the *Maid of Erin* camp. The elevation at Rainy Hollow, the foot of the hill, is 1,700 feet; at the *Maid of Erin* camp, 3,280 feet. This last ten miles of the road in British Columbia has a couple of bad hills and several soft stretches, but on the whole is in fair condition.

This is a big section with good possibilities, judging from my brief observations. I regret that my time was so limited, but I hope to make a more thorough investigation of this section next season.

Maid of Erin Group.

This group is composed of thirteen claims, situated on Mineral mountain, fifty-eight miles from Haines, on Lynn canal, and about fifteen miles south of Skagway. The property is owned by Conway, Kennedy & Burnham, of Skagway, Aaska, Mr. Kennedy being in charge of operations at the property. It has been held by the present owners for a number of years, who have encountered many difficulties in connection with obtaining transportation facilities. The property being in British Columbia, with about forty-five miles of the road through Alaska, has complicated the situation. However, the road for the greater part is now in fair condition, permitting of ore being hauled out, though at heavy cost. Some years ago 30 tons was shipped, which gave smelter returns of 32 per cent. copper and 56 oz. in silver a ton.

Ore-hauling at present costs 1¾ cents a pound from Rainy Hollow to Porcupine and 1 cent a pound is paid for return freight; 1,300 lb. is hauled down with a 2-horse team and 800 lb. freight taken on the up trip. I have no estimation of haulage from Porcupine to Haines, as it was expected to have the road in such repair to permit of motor-hauling. It was costing the owners $75 a ton to break, sort, sack, and deliver the ore to Haines. The freight and treatment from Haines to Tacoma smelter will amount to $11 a ton, $6 treatment, and $5 freight. This makes a total cost of $86 a ton for production; consequently it will take a high-grade ore to be profitable. This year 25 tons was shipped, assaying 35.05 oz. silver and 22.32 per cent. copper.

Mineral mountain, on which the claims are situated, consists of broad belts of limestone, slates, and sandstone, in places metamorphosed to quartzite, the whole apparently underlain by the granodiorite, which forms the western border of these sedimentaries lower down the hill. Directly in contact with the granite is a broad belt of crystalline limestone from 300 to 400 feet wide, through which intrude spurs of granite from the main mass to the west. In this belt of limestones, about 250 feet from the granite and paralleling the general strike of the contact, is a vein or, more properly, a zone of altered limestone, mainly calcite, about 12 feet wide on the north end, impregnated with specks, bunches, kidneys, and small veins, up to 4 feet in width, of bornite. Southerly along the zone the bornite crops in isolated bunches and small veins, probably caused by the intrusions of granite. The strike of the zone is north and south and the dip about 20 degrees to the east, following the general strike and bedding of the sedimentary. Along the immediate contact of the granite and limestone is also a mineralization of bornite, but it has not been opened up at all.

The work on the claims consists of a crosscut tunnel 100 feet vertically lower than the croppings, driven about 40 feet in the limestone toward the showing, to which it is probably 200 feet farther, as the vein dips into the hill. Another tunnel has been driven 40 feet across the showing and about 20 feet under it, exposing about 12 feet of a mineralization of small parallel veins and bunches of bornite, which is also disseminated throughout the calcite. Some small replacements of bornite occur in the underlying limestone foot-wall, but are not sufficient to make commercial ore. This is a fine showing of concentrating-ore. Directly over this tunnel the ore now being sorted for shipment is taken from the surface, where the bornite occurs in irregular veins, up to 2 feet thick, of solid ore through the calcite. Just south of this an open-cut or a small excavation in the vein has been made, from which the ore shipped some years ago was taken. A short distance south-east of these showings, on the top of a bench, a shaft has been sunk through the limestone to the ore.

Present operations employ five men, breaking, sorting, sacking, and hauling the ore down to the end of the Rainy Hollow road, three miles and a half from the workings. This hauling is done with a small Cleveland caterpillar tractor weighing 3,000 lb., having a 54-inch tread and a 5-foot belt. This machine takes 1 ton to a load on a trailer down the hill over grades of 20 per cent. with the load, and returns with 300 to 400 lb. of supplies. The owners this spring built this road for the tractor at a cost of $1,500, and certainly are deserving of a great deal of credit for their aggressiveness under most difficult conditions.

The ore, being a straight bornite in calcite gangue, would be ideal for flotation. Operations on a large scale could be carried on by opening up the ore-body from the south end on the point of the hill, or from the side of the hill, by a crosscut tunnel to the ore, and then drifting both ways from it on the ore.

The mountain is bare of timber, which would therefore have to be obtained from the valley below along the wagon-road. Wood for the camp is hauled up from the end of the road by the tractor. The ore could be trammed from the mine to the creek below, where ample water for milling purposes is available.

This is a fine, big, promising showing and gives good reasons for believing that extensive development will open up sufficient tonnage of milling-ore to justify the installation of a concentrating plant and improved transportation.

Hibernian Group. This group consists of five claims—*Glacier*, *Idaho*, *Texas*, *Boundary*, *May-flower*, and *Parrot*—situated east of the *Maid of Erin* group on Mineral mountain. The claims are owned by Dan Sullivan. The showing is a wide belt lying along the limestone, mineralized in places for a width of 40 feet, in which are stringers of chalcopyrite which, when bunched, make fair ore, but the greater portion of the belt is low grade. The ore is magnetite carrying chalcopyrite, very characteristic in the western contact of the Coast granites with the sedimentaries.

A shaft has been sunk to a depth of 10 feet next to the lime, showing about 2 feet of fair ore, the balance being low grade. About 10 feet east in an open-cut the vein shows a width of 10 feet, in which are a few inches of fair ore, while the balance is low grade. A grab sample was taken of the best-looking ore on the dump, giving 2.5 per cent. copper and 0.5 oz. silver a ton.

This showing of ore, if on tide-water, would merit a lot of work, but, situated as it is with the possibilities of rail transportation rather remote, its values are not very encouraging.

Victoria. This claim is owned by Conway, Burnham & Kennedy. It lies on the trail from the end of the wagon-road to the *Maid of Erin* property. An open-cut about 4 feet deep exposes a vein, apparently about 12 feet wide, lying in limestone and mineralized with pyrite, galena, and blende. It strikes north and south, which is the general strike of all the veins in this section. A grab sample of the broken ore in the cut, and which should be a fair average of the whole, gave 21.4 per cent. lead, 21.4 per cent. zinc, and 4 oz. silver a ton. This is another showing that would be well worth opening up if it were handy for shipping.

With a good motor-road from Haines to Porcupine, ensuring cheap supplies and haulage, and a good wagon-road the remainder of the distance, this section would have some chance for development.

Atlin Section.

This section has been a big producer of placer gold for a number of years, and in all probability will continue to do so for years to come. The section has also produced one quartz property in the *Engineer* mine, which has all the ear-marks of becoming the greatest gold-producer in the Province. This will naturally stimulate the exploration of the same class of deposits in other parts of the section and will turn attention to lode-mining in general, which, so far, has been neglected.

I am including in this report a short description of the *Venus* and *Venus Extension* properties, which, though on the Yukon side of the boundary, are representative of possible showings farther south on the British Columbia side of the boundary.

Venus Group. This group* is part of the mineral holdings of McKenzie & Mann, at which the town of Conrad flourished a few years ago. The property is situated on the west side of Windy arm, about sixteen miles from the town of Carcross.

* Dominion Geological Survey, Summary Report, 1916, page 39.

Being right on the water's edge, it is ideally located for mining, milling, and transportation. It was operated up to about the middle of the summer. The main workings consist of a crosscut tunnel from the side-hill to the vein, a distance of about 500 feet through andesite country-rock. Drifts have been run both north and south on the vein for approximately 500 feet each way from the tunnel. At the south end of the south drift a winze has been sunk on the vein to a depth of about 60 feet (no measurements made), in good-looking ore all the way. At about 30 feet down from the drift-level the vein splits and has been followed on the hanging-wall for the remaining 30 feet to the bottom. Evidently the foot-wall split was followed for some distance, but abandoned in favour of the hanging-wall showing.

Throughout the whole 1,000 feet of drifting the work has been in ore, supposedly of better grade in spots, from the fact that portions have been or were being stoped. I was reliably informed that the whole vein will average between $10 and $12 a ton in gold, silver, and lead values, and maintain an average width of 2½ feet. The vein is apparently a filled fissure in the andesite country-rock, having a strike of N. 30° W. and dipping south-west at from 30 to 35 degrees. The main filling is quartz mineralized with arsenopyrites and galena, the latter carrying the silver and possibly a small percentage of the gold values, a concentrate of the iron assaying about $20 a ton in gold. There is considerable oxidation of iron in the vein, and resulting chlorides of silver which have been lost in milling operations.

The damp oxides have caused some little trouble in stoping on account of them hanging on the flat foot-wall. To assist this crosscuts have been run into the foot-wall and chute raises put up to the stopes. The most of the stoping has been done on the north drift, and without examining or measuring the stopes I would roughly estimate that there is a sufficient tonnage of ore about the drift-level to the surface to feed a mill of 100 tons capacity in twenty-four hours for a year or more. The average feed to the mill during the last operation was 2 per cent. lead, $3 in gold, and 10 oz. in silver a ton; the ratio of concentration was from 10 to 12 into 1, and a product of 14 per cent. lead, 100 oz. in silver, and 1 oz. in gold was made. The concentrates consist of both the iron and lead sulphide, accounting for a low percentage of lead. The recovery has only been between 60 and 65 per cent., due largly to mechanical losses in the mill, which was treating about 60 tons a day.

There has probably been a slight enrichment in gold values in this upper oxidized zone, due to the oxidation and removal of the iron; but I judge this would be offset by the silver losses, due to leaching, and I would therefore look for about the same values at depth below the oxidation when the primary sulphides ore reached. It seems reasonably certain that, with economical mining and efficient concentrating, with an average of $10 to $12 ore, this can be made a profitable undertaking.

The equipment on the property consists of a 2-bucket aerial tramway from the mine to the mill located on the beach, and a compressor plant consisting of a steam-driven, 6-drill Rand-Ingersoll straight-line compressor, with a 2-inch air-line from the receiver to the mill. Fuel is obtained from the head of the arm, about three miles from the mine, costing from $9 to $10 a cord laid down at the boilers. This steam plant also supplies power for the concentrator, pump, generator, etc.

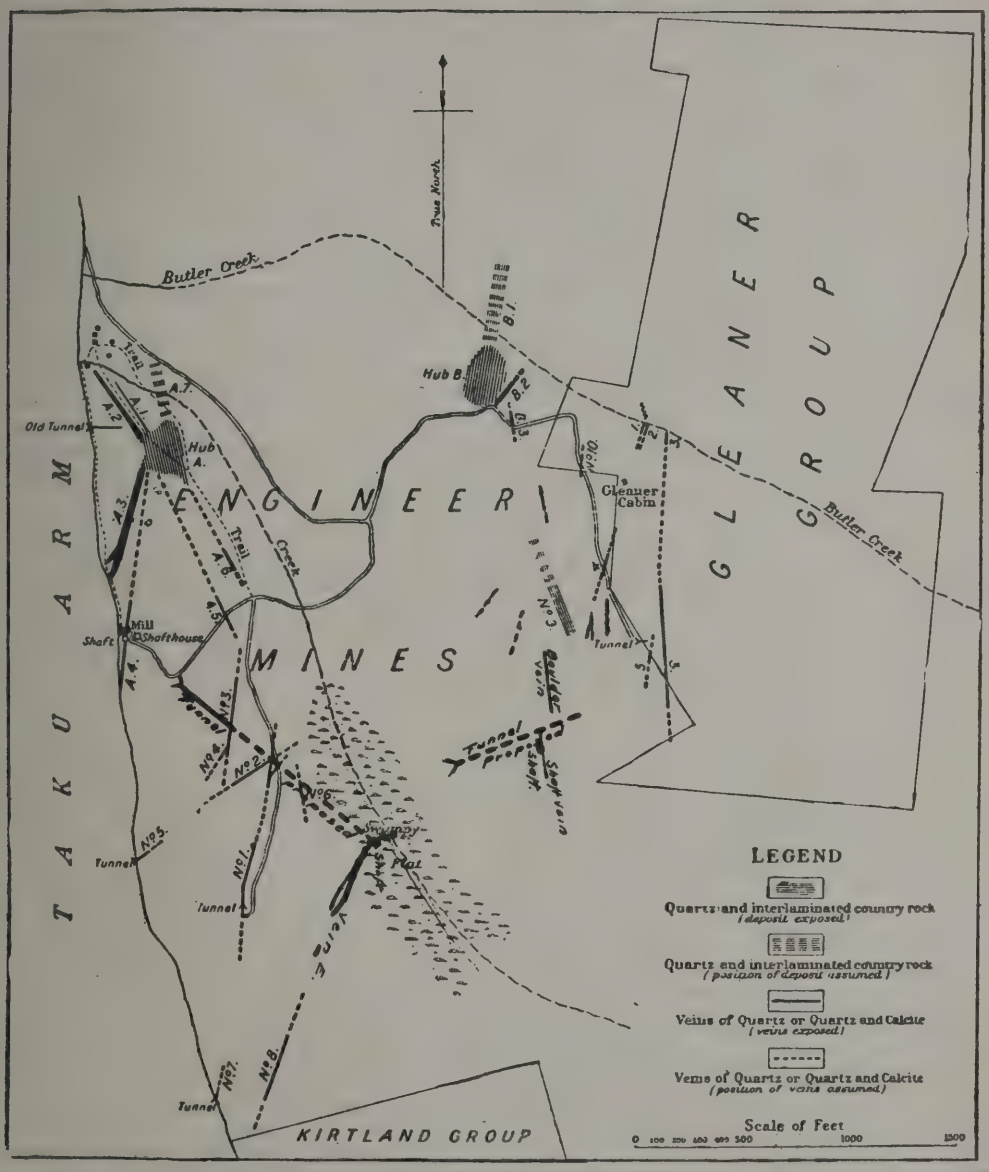
The concentrator was installed about ten years ago and altogether has not been in operation more than a year during that time. It is equipped with a 9- x 15-inch jaw-crusher, rolls, 5-foot Huntington mill, Hartz type jigs, Wilfleys, and vanners. The milling process was not investigated by me, so that no opinion is advanced as to its adaptability for efficiency.

Freight from the mine to the White Pass Railway at Carcross costs $1 a ton, which includes loading at the mine and transfering to cars at railway. From Carcross to Skagway costs $2.50 and up a ton, depending on the value of the ore. The railway freight tariff quotes a rate of $6.25 a ton on sacked ore from the *Venus* mine to southern coast smelter.

Venus Extension Group.

This group, as the name indicates, is located on the continuation of the *Venus* vein. It is owned by E. Fleming, of Carcross, Y.T. The claims are *Venus Extension*, *Red Deer*, and *Humper No. 1*. Work done on the property is mainly on the *Venus* vein and consists of a tunnel and a shaft. The tunnel has been driven south on the vein from the surface for 500 feet, and must be about the end line of the claim. There is a fraction of about 500 feet between this group and the *Venus*. The drift shows the vein to have the main characteristics of the *Venus* vein, except that it is rather more oxidized. The shaft has been sunk 110 feet on the vein and short drifts run both ways from the

bottom. This was full of water at the time of my visit, but I was able to procure the results of a very carefully taken set of samples down the shaft. These were taken at regular intervals of 10 feet and averaged a trifle over $15 a ton in gold and silver values (silver, 60 cents an oz.) for an average width of 2½ feet, corresponding very closely to values and width of the *Venus* vein, possibly with a trifle higher gold values. The ore will concentrate about 10 or 12 into 1.



Map showing Vein-outcrops on Engineer and Gleaner Groups, Atlin Mining Division.

The property is equipped with a compressor and boiler plant, installed on the lake-shore, similar to the one on the *Venus*, and connected with the mine by a 4-inch air-line. There are good reasons to believe that, under conditions which will prevail after the war, this property, equipped with a modern concentrator and efficiently handled, can be made a good profit-producing enterprise.

Engineer Group.

This group* comprises eleven Crown-granted claims—*Northern Partnership No. 1, Northern Partnership No. 2, Northern Partnership No. 3, Northern Partnership No. 4, Northern Partnership No. 5, Engineer No. 1, Mickey, Plato, Philadelphia Fraction, Mill Brook*, and *Daisy*—situated on the east side of Taku arm, about ten miles south of Golden Gate, sixty-five miles from Carcross, on the White Pass Railroad, and twenty-five miles from Atlin. The claims are located two deep along the shore from the water's edge up the hill. The property was owned by the late Captain James Alexander, who, with Mrs. Alexander, were lost in the S.S, "Princess Sophia" disaster in Lynn canal in October of this year. The captain had "stayed with it" at this one property for over ten years through all kinds of adverse conditions, and was on his way out to close a deal for the property, and reap the reward, when the fates decreed otherwise. No information is available at the present time as to the future plans for the property.

Quoting from D. D. Cairnes's report of 1913, "The ores at the *Enginecr* mine occur in veins mainly in Jura-Cretaceous shales and finely textured greywackes that vary from dark greenish and brownish to almost black in colour. The veins range from simple veins a few inches in thickness to compound veins over 200 feet thick, and consist largely of quartz, calcite, and intercalated and brecciated wall-rock. The chief metallic mineral is native gold; in addition, small particles of tellurides, as well as some pyrite and native antimony, also occur. The veins are thus of value only for their gold contents.

"The beds have been invaded by dykes of andesite and granite porphyry, and in places are faulted, folded, and considerably distorted, but have a general strike of about N. 63° W. and dip to the north-east at an average angle of about 35 degrees.

"Two large, central, compound veins or hubs consisting of quartz and intercalated and brecciated shale, slate, and altered rocks occur, from which several veins radiate, most of them in north-westerly and south-easterly directions. In addition, a number of veins have been discovered which are not, as yet, traceable to any central quartz area.

"Hub A is at least 200 feet wide at its widest point and is over 300 feet in length. The mass consists largely of quartz, but also contains a large proportion of intercalated bands of shale slate.

"Hub B is very similar in appearance to hub A, contains a large amount of intercalated and brecciated shale and slate, and is in reality a compound vein. It is at least 270 feet wide. Toward the edges of the vein the proportion of rock gradually increases, producing walls of indefinite character.

"The majority of the narrower veins are compounded almost entirely of quartz, with comparatively little calcite. The quartz is characteristically well crystallized and long delicate prisms are very common; these occur in parallel bands with comb-structures or radiate from a central mass or particle of ore or rock. In the intercrystal spaces that thus result the metallic minerals have largely been deposited.

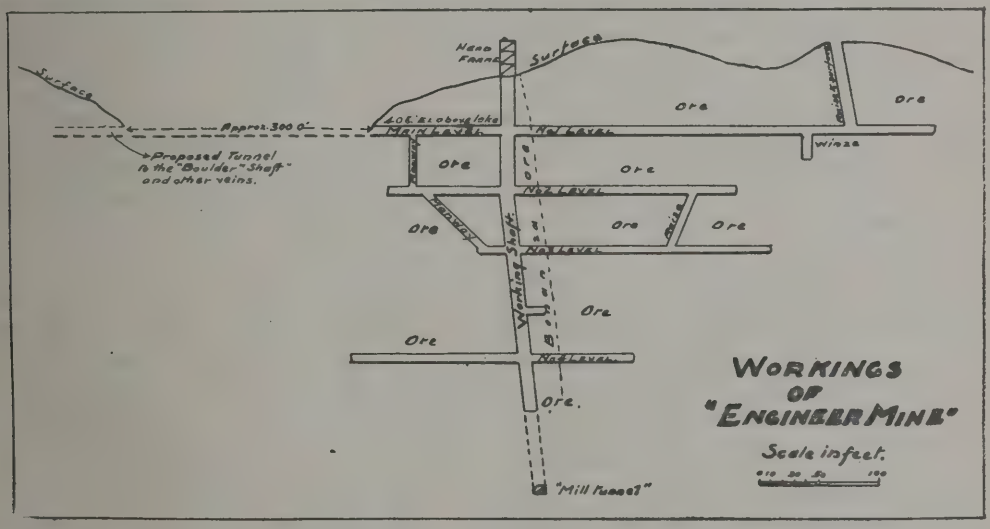
"Native gold is the most common metallic mineral in the veins, and is in places plentifully distributed through pockets or shoots of ore either in fine grains or thin scales. Associated with the gold in places are imperfect prismatic forms or brass-yellow tellurides, probably calaverite."

Development-work done on the property consists of a great number of open-cuts and strippings and several tunnels driven on the most promising-looking veins. This surface work has exposed about twenty-five veins, varying in width from a few inches up to 4 feet, the majority of them showing visible gold at some place in them and a few of them containing shoots and pockets of bonanza ore. Two of these are especially rich, the "boulder vein" and the "shaft vein." The greater part of development so far has been on vein E. (*See* sketch.) A shaft has been sunk 275 feet from the surface, from which four levels have been run. No. 1 level is 50 feet below the collar of the shaft and is driven from the surface at 460 feet elevation above the lake. This is the working-level to which all ore and waste is hoisted from the underground workings. From the mouth of the tunnel to the shaft is 115 feet, and the tunnel has been continued beyond the shaft for 355 feet, all on the vein. At 270 feet beyond or south of the shaft a raise has been put through to the surface. No. 2 level, 45 feet below No. 1, has been driven 100 feet north and 190 feet south of the shaft, on the vein both ways. A manway has been put through from the end of the north drift to the No. 1 level, coming out about 30 feet from the portal. No. 3 level, 50 feet below No. 2, has a short drift of 30 feet, north from which a

* Dominion Geological Survey, Memoir 37, 1913, by D. D. Cairnes. Minister of Mines' Report, 1904.

sloping manway has been put up connecting with a manway from No. 2 level, and a drift sunk of 210 feet, from which a raise has been driven to No. 2 level. No. 4 level, 90 feet below No. 3, has a drift north of 140 feet and south 90 feet, both on the vein. The shaft has been continued for 40 feet below the No. 4 level during the past summer, showing the vein to be 2 feet in width, with visible gold on each wall. All this underground work has been in ore. There is a bonanza shoot of ore showing for a length of about 30 feet on all the levels on the south side of the shaft, varying in thickness from a knife-blade to 6 inches of heavy gold, in one place reaching a width of 18 inches.

In development-work the waste is broken about 10 feet ahead of the ore, which is afterwards taken down with as little shooting as possible and taken to the sorting- tables,where it is broken up and sorted into three grades. The first grade is that showing visible gold, which is sacked for treatment in a ball-mill. The second grade, no visible gold, is known to be high grade, from $125 to $175 a ton, and is sacked for shipment. The balance or third grade is put on the dump for future treatment. The first grade is accumulated until there is sufficient for a run of the mill, from 600 to 1,000 lb. being the usual charge. It is first put through a small jaw-crusher which crushes to about ¼ inch size; then into a 5-foot ball-mill using steel balls, where it is pulverized in from two to two and a half hours. Two or three flasks of mercury (from 150 to 225 lb.), according to the estimated gold content of the ore, are then added and the barrel revolved for twenty or thirty minutes (a longer time flours the mercury) for amalgamation. The contents are then thoroughly washed and the amalgam removed, squeezed, and retorted. The record run of this mill was 24 lb. 8 oz. (troy) of gold from 160 lb. of ore. The tailings from the ball-mill are washed into tanks, settled, dried, and shipped to the smelter with the second


Surface
Approx. 300 0'
Proposed Tunnel to the "Boulder" Shaft and other veins.
Surface
Ore
Ore
Ore

been worked at intervals and a distance of 50 feet been driven, requiring probably 300 feet farther to reach the "boulder" vein, and about 900 feet to reach the farthest of the upper series of veins, and obtaining a depth of 460 feet under it. The old 3-compartment shaft at the head of the mill will be sunk from its present depth of 75 feet to intersect a very rich vein cropping at the water's edge, and on which a shallow shaft was sunk a short distance back from the water. This vein is known to run into hub A; consequently can be drifted on from the shaft to the hub, and all ore developed from it hoisted through the shaft to the mill storage-bins. This appears to be a very commendable plan of development, for it will not only provide haulage, but will expose any number of working-faces of ore, from which a large capacity mill can be supplied.

Altogether it is a wonderful showing of gold, and there is every reason to believe that it can be developed into one of the greatest gold-producers on the continent.

Gleaner Group. This group consists of three claims lying east of and adjoining the *Engineer* group up the hill. There is a good wagon-road to the *Gleaner* cabin from the shore of Taku arm at the mine landing. The rock formations on these claims are identical with those of the *Engineer* mine; that is, slates and shales intruded by dykes of andesite and granite porphyry. Two or three quartz veins have been discovered and some work done on each of them. A tunnel has been driven for 35 feet on a small 8-inch quartz vein from the north side of a small creek, from which, it is said, several sacks of free-gold quartz was taken. There are several open-cuts and strippings on quartz-outcrops around this creek, none of which apparently amount to much.

Further south, on a lower vein, which is possibly the extension of the *Mickey* vein of the *Engineer* group, some 200 feet of open drifting has been done north of the shaft and also a short drift south of the shaft. The shaft is about 40 feet deep and full of water. It is not known what values were obtained in these cuts or in the shaft. This vein strikes N. 50° W. About 50 feet vertically lower a tunnel was run to crosscut the vein, which, however, was not encountered, the face of the tunnel being now in andesite

Kirtland Group. This group of six claims adjoins the *Engineer* group on the south and extends along the shore of Taku arm. Comparatively little work has been done, and that mainly on the *Jersey Lily* claim, adjoining the end claim of the *Engineer* group. Formation and vein occurrences are similar on both groups. I understand some gold has been found, but it looks as if all the surrounding properties were content to rest on the reputation of the *Engineer*.

Sweepstake Group. This group of seven claims—*Sweepstake No. 1* to *Sweepstake No. 6*, inclusive, and *Golden Hope*—is owned by Ben Nichol and Jack Dunham. The group is located north of and adjoining the *Engineer* group, two claims back from the lake, extending along the side of the mountain. The vein, which attains a width of 25 feet in places, is brecciated quartz and slate filling, in some cuts the quartz and slate showing a banded structure. The vein is exposed by open-cuts at intervals of 50 feet, and has a strike of N. 20° W., dipping slightly to the west. At 3,030 feet elevation, or 830 feet above the lake, the vein shows a width of 30 feet of banded slate and quartz. At 3,175 feet elevation the vein is 25 feet wide, and at 3,200 feet the vein is predominantly slate, with some quartz. At 3,450 feet elevation a tunnel has been driven 35 feet on a 12-inch cross-vein of quartz, striking at N. 55° E., in which free gold is said to have been found. Flakes of free gold have also been found in the main vein, but no extent of high grade has yet been exposed. It is a big vein and would produce a big tonnage if the values were sufficient.

Happy Sullivan Group. This group consists of three claims—*Crackerjack*, *Gold Hill*, and *Gold Bullion*—and is situated about a mile and a half from the lake on the north bank of Sheep creek. The showing is a big quartz vein 22 feet wide lying beside a diorite dyke on the west; the east wall appears to be an altered, soft, greyish rock through which are small veins of white watery-looking quartz. The vein shows up the hill for a length of 50 feet, at an elevation of 3,600 feet at the lowest exposure. A sample was taken across here by breaking off as average as possible with a prospecting-pick; it gave returns of only a trace each of gold and silver. A tunnel has been started from a gulch below, and is in 48 feet, crosscutting toward the vein. This is a strong vein, and it is to be hoped that, at the depth which the tunnel will obtain, the values will improve, for it is well situated for mining and transportation.

Brown Group. This group of four claims—*Brownie No. 1, Brownie No. 3, Brownie No. 4,* and *Brownie No. 5*—is owned by Dunham, Nichol, Kershaw & Gilmore. The claims are situated about half a mile up the Wann river, which flows into the arm from Edgar lake, about half a mile south of the *Engineer*. There is a fine water-power available on the Wann river about a mile from Taku arm. Edgar lake is 280 feet higher than the arm, with the greater part of the drop about a mile from the mouth of the river. The two lakes, Edgar and Nelson, drained by the river from an extensive reservoir. The trail from the *Engineer* wagon-road extends up the east side of the Wann river for some distance, and a trail has been built from the upper end, part way down, leaving a small portion along the river unfinished.

At an elevation of about 50 feet above the arm, on the west bank of the river and about 40 feet above the water, an open-cut into the side-hill exposes a vein, 4 feet wide, of quartz sparingly mineralized with galena, blende, and some grey-copper in places. Along one wall there is a narrow vein of high-grade ore. A tunnel has been started at the edge of the river and is just into the solid, showing two seams of quartz carrying galena and blende. The vein is worth exploration on account of the high-grade ore showing in the upper cut.

Along the shore of the arm a number of open-cuts have been put in, following small veins of quartz which apparently are not persistent, being small replacements along the slips in the sheared or gneissoid granite.

White Moose Group. This group, as described in my preliminary report, is evidently the *Rupert* group; the *White Moose* claims lying along the shore, while the *Rupert* claims are well up on the mountain. The claims of the *White Moose* group are eight in number—*Pansy, Rose, Buttercup, Calder, Primrose, Daisy, Merry,* and *Daffodil*—and are owned by Mr. Partidge and associates. As I did not examine the showings, I will quote from D. D. Cairnes's Report of 1913.

"The rock formation consists of a greenish schistose amphibolite, much faulted, contorted, and altered. The main showing on the property is a quartz vein from 18 inches to 4 feet wide, fairly well mineralized with grey-copper, pyrite, and chalcopyrite, with a little galena also showing. On the north end of the vein a small shaft has been sunk, exposing the vein 2 feet wide, of nearly solid grey-copper, chalcopyrite, and galena. On the southern end of the claims some open-cuts have been made, a shallow shaft sunk, all exposing ore, from which assays of from $10 to $15 in gold were obtained and silver of from 20 to 100 oz. a ton."

Rupert Group. This group (described in my preliminary report as the *White Moose* group) is situated on the east slope of Whitemoose mountain, on the west side of Taku arm, across the arm from and a little south of the *Engineer* group. The camp is on the bank, about 100 feet from the water's edge, at which there is a floating dock for landing. I followed the trail leading from the camp up the hill to a tunnel at an elevation of 4,100 feet, or about 1,900 feet above the lake. The tunnel starts on a face of quartz about 8 feet wide lying in the granite formation, and follows the vein for 80 feet where the quartz pitches out; the balance of the distance to the face, 160 feet, is in granite. At 40 feet from the mouth of the tunnel the vein splits, and, as stated, continues to 80 feet. There is a crosscut to the right from the 80-foot point, for the purpose, no doubt, of picking up the right fork of the vein. The water in this was 2 or 3 feet deep, so that it was impossible to examine it. The split in the tunnel shows on the surface, but it is impossible to trace the vein any farther than showing in the tunnel. The vein strikes N. 80° W. and dips 70 degrees to the north. The quartz is sparingly mineralized with chalcopyrite, pyrite, and a little galena.

I have been informed since going over the property that there are three or four more veins on it, and from their description I judge that they all have about the same characteristics, and that the one mentioned is probably the best-looking one of the bunch. It was unfortunate that I had no one with me familiar with the ground, for I could have taken in all the showings of the claims as well as the one I saw.

Laverdiere Group. This group consists of six claims and is owned by the Laverdiere Bros. The property is situated on the west side of Hoboe creek, a small stream emptying into West bay at the extreme south of West channel. It is about two miles from the mouth of the creek, the whole distance being a perfectly flat valley-floor, with a fair trail from West bay to the property. The rock formation is a contact between the Coast granites on the west and the greenstone-schists and limestones which form the bed of the valley and extend along the base of the hill.

The main showing of this group occurs in this contact and is of contact metamorphic origin. There is a general mineralization along the contact through to the *Callaghan* group. The best showing yet exposed has been opened up by a tunnel 180 feet long, driven at an elevation of 2,240 feet, or about 40 feet above Atlin lake. In this tunnel the mineralized zone extends from about 30 feet from the collar to about 20 feet from the face, or about 130 feet in width. The body dips 70 degrees to the west. Of the total width of ore, 130 feet, there is between 30 and 40 feet of pretty fair ore, occurring as bands of magnetite, carrying chalcopyrite, up to 10 or 12 feet wide. Further development-work should be done here by diamond-drilling, which would probably be the best, as the depth of the deposit could be more readily determined, or by drifting on the best-looking band of ore to ascertain the extent of the deposit. It can be seen on the surface that there are bunches of magnetite, carrying chalcopyrite, in the limestone-belt for 200 or 300 feet south of the tunnel. A general sample was taken from the dump, which gave assay returns of 1.7 per cent. copper and a trace each of gold and silver a ton. This is probably a fair average of all the mineralized portions of the deposit. The ore would therefore have to be concentrated, for the chalcopyrite is so distributed that, I believe, hand sorting to a shipping grade would be impossible. This is a big deposit and worth sufficient exploration to get the average content and probable tonnage information necessary before a concentrating plant could be decided on.

About 100 feet north of this tunnel another crosscut tunnel has been driven about 40 feet, cutting a deposit of almost pure pyrrhotite, containing less chalcopyrite than the magnetite in the other showing. Some cobalt bloom was noticed in pieces picked up from the dump.

Some 1,000 feet south of the long tunnel another crosscut tunnel has been driven for 213 feet into the limestone, the first straight portion being 168 feet; then 27 feet to the left at right angles; then straight ahead again for 18 feet to the face. A little scattered chalcopyrite shows in the face, and I judge there is a little disseminated throughout the limestone. It is said that free gold was found in an open-cut just above this tunnel.

Probably 1,000 feet south of this tunnel an open-cut and drift has been driven about 50 feet, following a small quartz vein lying in the granites. The face of this tunnel shows only a mud-seam marking the fissure, and about a foot on each side of it of altered granite. A sample across it gave only a trace of each of gold and silver. It is claimed that high silver values were obtained near the mouth of this tunnel in a grey-copper ore. This showing will be tapped by a crosscut tunnel now being driven about 35 feet vertically lower. It was in 40 feet when I was there, and the face then looked as if it were close to the vein, and I have no later information as to the results of this work.

Mining conditions are very favourable for this property, being only two miles from the lake, on a flat grade, plenty of water for power and other purposes, and plenty of timber. The property is under a three-year bond to a Mr. Zortman, who contemplates putting in a small compressor plant and thoroughly investigating the magnetite-showing by sinking 100 feet and drifting and crosscutting at that level. From a general sizing-up of the ore exposed and the formation, there are good reasons to believe that this property will develop into a big concentrating proposition.

Callaghan Group. This group, consisting of six claims owned by Mrs. Callaghan, is situated adjoining the *Laverdiere* group on the north and extending through to the shore of West bay. The same ore occurrences are found here in the same formation as on the *Laverdiere*, being on the continuation of the contact of the Coast granites and sedimentaries. The claims are heavily timbered and overburdened, and as little work has been done by way of stripping or open-cutting, no conclusions can be made as to the extent of the mineralization. Two quartz veins have had a little work done on them on the shore of West bay. They lie in a greenish schistose formation which is badly distorted; consequently the veins have no continuity and are of little importance. The quartz carries good gold values, a few pieces picked from one of the open cuts giving assays of 1.58 oz. gold and 7 oz. silver to the ton.

Copper Island. This island is situated on the south end of Atlin lake and has had claims staked and restaked from time to time on the copper-showings there. At present I think all the claims have lapsed. The rock formation is a reddish-brown granular basalt, through which are small calcite-filled fissures in which are slabs and seams of native copper. There appears to be no other mineralization, no sulphides of copper of any kind from which the native copper could be redeposited, from which it may be concluded that the native copper was primarily deposited as such. An open-cut 30 feet long, with a face

12 or 15 feet high, shows about 8 inches of calcite, with a streak of native copper through it. No ore of this kind has been discovered in sufficient quantities to be of workable value. The country-rock is slightly mineralized with native copper near these small calcite veins.

There is evidently a wide belt of this volcanic rock which is said to extend north as far as Edgar lake, where it is a better grade on account of the quartz and calcite veins in the vicinity carrying chalcopyrite and bornite. The belt extends south as far as the extreme southern end of Atlin lake. It would seem that this basaltic belt would be well worth thoroughly prospecting, for it is probable that some portion of it will carry profitable quantities of copper.

Munroe Mountain.

There are numerous quartz veins cropping all over this mountain, but the only development has been done on the *Imperial* group of four claims, owned by James Stokes, of Atlin, B.C., and associates. These claims are about five miles from Atlin. A branch from the main road from Atlin to Discovery runs to the foot of the hill. The property is very accessible and mining conditions perfect.

The showing consists of a vein, with a general north-west and south-east trend and a dip of from 50 to 60 degrees to the west, of from 6 inches to 3 feet in width, lying in a wide diorite-belt. The vein-filling is quartz, carrying a trace of chalcopyrite and pyrite, and for the most part is badly crushed and oxidized. The showing has been developed by a crosscut of 20 feet from the surface to the vein; then a drift on the vein of 20 feet to the east and 160 feet to the west. The ore-shoot for a length of 50 feet has been stoped through to the surface above the crosscut, as well as some underhand stoping below the drift-level. This ore was extracted some years ago and milled in a 5-stamp mill situated at the foot of the hill. It is stated that the feed to the mill averaged about $7 a ton in free gold. West from the tunnel on the drift-level the quartz has split up and pinched for about 70 feet; from there for 25 feet is good-looking quartz, on which a winze or a small underhand stope has been sunk to a depth of 8 feet.

Another level has been opened about 100 feet below this by a crosscut of 110 feet from the surface to the vein, on which short drifts have been run both ways from the crosscut. The vein on the lower level attains a width in places of 8 feet, very much oxidized and shattered.

The following samples were taken:—

No.	Width.	Location.	Values.	
			Gold.	Silver.
	Inches.		Oz.	Oz.
1	..	Broken quartz from two open-cuts on the surface west of where stope breaks through	0 90	0.3
2	20	Across E. face, upper tunnel, 6 inches quartz, balance oxidized	0.02	Trace.
3	6	Quartz, W. face, upper tunnel	0.06	0.2
4	22	Quartz, 10 feet back from W. face	0.02	Trace.
5	20	Quartz, 20 feet back from W. face	0.02	Trace.
6	16	Quartz, at top of W. end of 8-foot winze	0.02	0.1
7	10	Quartz, bottom of E. face of winze	0.04	0.4
8	20	Quartz, 33 feet E. of E. end of winze, half-way to W. end of stope	1.68	0.4
9	24	Broken-up quartz, 20 feet from E. face, lower tunnel	Trace.	Trace.
10	18	Quartz, W. face, lower tunnel	Trace.	Trace.

Samples 1 to 8 would seem to indicate that some quartz west of the stope is of workable values, but the tonnage would be small.

The continuation of the lower tunnel to get into more solid quartz and away from the oxidizing effects near the surface might expose another ore-shoot containing such values as that stoped from the upper level. Also the continuation of the upper tunnel west might be good exploration. It seems to be about all that can be done.

Lakeview Group.

This group, consisting of six claims—*Lakeview*, *Lakeview Extension*, *Lakeview No. 2*, *Lakeview No. 3*, *Golden Hill*, and *Golden Hill No. 1*—is owned by Sands, Morrison & Hodges, of Discovery, B.C. The claims are situated on Star mountain, between Birch and Boulder creeks, and are well located for mining and transportation. The rock formation is a dioritic rock, altered for a foot or two on each side of the vein, which is of quartz slightly mineralized with pyrite, galena, and an occasional speck of native gold. A tunnel has been driven 140 feet on the vein, showing it to have an average of 2 feet. It it a fine-looking vein. About 75 feet above the tunnel a shaft has been sunk on the vein to a depth

of 50 feet, and an open-cut run along the vein above the shaft for a length of 60 feet. A sample taken from the dump at the collar of the shaft gave low values in gold and silver. It is a very good showing of quartz, but evidently of insufficient values, so far as opened up, to give much encouragement for further work.

PLACER OPERATIONS.

I am indebted to the Gold Commissioner, J. A. Fraser, for the following information on placer operations of the Atlin Mining Division.

The output of placer gold for this year is less than that for the past few years, due to the increasing scarcity of labour, expensive operating, and, in cases, water shortage. The production totals about $218,000 for this year, as compared with $305,000 for 1917.

On McKee creek the only operator has been the Delta Gold Mining Company, working company ground under the management of George Adams. About eight men were employed throughout the season and the output was about $5,000.

On Pine creek two groups of laymen were operating. Mobley and Schultz had eleven men working at Discovery, using five "giants," three for washing and two for stacking tailings. Two pits were sluiced, producing approximately $25,000.

About a mile above Discovery, on Tar flats, the Atlin Gold Mines Company, under the management of J. M. Ruffner, had six laymen working. No returns of production available.

On Birch creek the Dominion Trust Company ground was worked on a "lay" by H. P. Pearse and three partners. Water was very scarce and a comparatively small yardage of gravel was moved. No returns.

On Boulder creek Charles Miller had two "lays"—one working seven men, which produced $21,000; the other, drift-mining, employing three men, whose output was $4,000.

Above Miller, Gus Anderson with a couple more men took $4,300 out of his own ground.

Farther up the creek, J. H. Black and partners took out about $2,500.

On Ruby creek the Placer Gold Mines Company, operating under the management of T. M. Daulton, who had in his employ about fourteen men during the season, produced about $65,000. This company has good ground, a good outfit, and under efficient handling appears to be operating about as successfully as any in this section.

Hy. Irish and G. A. Colburn were working their own ground on this creek. No returns.

On Otter creek the Mines d'Otter, under the management of H. Maluin (J. E. Moran, foreman), employing about six men, produced $11,000.

Spruce Creek.—There has been considerable discussion for the last year or two amongst the operators on this creek regarding the construction of a bed-rock drain to serve the different leases requiring it. On instructions from the Mines Department, I made a trip in last winter to look over the situation and get what data and information available at that time of the year. Three alternative routes were selected and submitted to the Department, together with an approximation of the cost of construction. The Department signified its willingness to co-operate with the owners and operators whenever they had a definite plan and agreement amongst themselves. There are many complications in connection with the scheme which will no doubt be worked out to every one's satisfaction in time.

The largest operator on the creek this year has been I. Matthews, who owns and works considerable ground with several laymen. A total of thirteen men produced about $41,000 for the year.

Otto Miller and partners, on their own ground, with three men working, took out good wages.

The same applies to Smith, Conroy & Carlson on their ground, and J. R. Clay on his.

The Atlin Gold Mining Company, under the management of J. M. Ruffner, had several laymen on its ground, the results from which are not available at present.

A few other owners and laymen did a little prospecting.

On O'Donnell creek Noland & Darr did some prospecting.

White & Murphy worked, partly on a "lay." No returns.

A little prospecting was done on several other creeks, with unknown results.

CASSIAR DISTRICT.

ATLIN MINING DIVISION.

Report of J. A. Fraser, Gold Commissioner.

I have the honour to submit my report on mining operations in the Atlin Mining Division of Cassiar District for the year ending December 31st, 1918.

I regret that the returns disclose a falling-off in production as compared with the preceding year, but it exceeds that of some years in the past, when there was more than twice the number of men engaged in mining in the district. Owing principally to war conditions, there were less than 400 people (men, women, and children) in the district, and not more than 150 were engaged in actually mining the amount produced. The revenue derived from purely mining sources exceeds that derived from similar sources in 1917, as do also the aggregate receipts from all sources. As in other years, a considerable amount of the gold actually produced has not been reported within the year, and, as usual, some not at all. Indeed, one operator has, since December 31st and too late for inclusion in the returns for 1918, reported an output of about $10,000 which was actually recovered early in the year (1918), and there are other lots of which I have some knowledge, but proper (or any) reports and returns of which I have failed to secure up to date.

The water-supply was very full and satisfactory on some of the creeks, whilst on others it was disappointing as usual, and in one or two instances the chief embarrassment was because of the excessive quantity, and the necessity for proper conservation and storage facilities was again emphasized, as it has been from season to season since the inception of the camp, and the effect was manifested by a lesser amount produced than might otherwise have been. The most serious handicaps, however, were the high cost of labour, of living, and of explosives, the latter being practically prohibitive, and, indeed, the condition of the labour market in conjunction with those other handicaps caused some operators to suspend operations altogether and others to close down earlier than usual.

I may say with respect to the labour situation that quite a percentage of the best men in the camp enlisted for active service while enlistment was possible, and last season practically all who were eligible under the "Military Service Act" were drafted, leaving the labour market at the mercy of foreigners, who did not hesitate to take advantage of the situation, and the result was the prevalence of a rate of wages which only those operating on the highest class ground in the camp could afford to pay, and those not so fortunately situated simply did as little as possible. In fact, unless there is some improvement in this situation which will reduce the cost of production, I anticipate a further falling-off in the aggregate amount produced this coming season.

McKee Creek.

Taking the creeks in the same order as in former years, I may say that on McKee creek the Delta Gold Mining Company, under the management of George Adams, commenced operations on May 1st, and with a force varying from sixteen to six carried on until September 2nd, when operations were closed down for the season. The supply of water on this creek was very satisfactory during the above-mentioned period, but, unfortunately, the previous winter's prospecting operations, which were conducted much lower down on the creek, failed to satisfactorily locate the exact position of the pay-streak, which had apparently passed from the bed of the creek at the point where the summer operations were being carried on, under a heavy overburden of gravel on the north side of the creek, and it was deemed advisable to close down and adopt a less expensive method of prospecting. Operations of that nature were commenced early this winter, and will probably be continued until the pay-streak is again satisfactorily located.

Pine Creek.

Some of the properties held on this creek changed hands during the winter of 1917-18, a new organization known as the Atlin Gold Mines Company, under the management of J. M.

Ruffner, having acquired all the leases, plant, etc., formerly held and owned by the Atlin Consolidated Mining Company. The holdings, plant, and assets of the North Columbia Gold Mining Company, the Pine Creek Power Company, Limited, the O'Donnel Placers Company, and the Columbian Mines Company were acquired by F. H. Mobley, of Prince Rupert, who subsequently conveyed a half-interest to L. Schulz, of this place. I understand another new organization, to be known as the Discovery Mining and Power Company, Limited, has been formed, to which the leases and other assets above mentioned will be assigned in due course by Mobley & Schulz.

On a portion of the property acquired by Mobley & Schulz, known as the *Eastern* group of leases, a crew of laymen, of about twelve in number, operated hydraulically from June 24th until about October 31st with very gratifying results. I am not aware of any work being done on any of those holdings this winter, but I fully expect the new company will be operating in force next season, provided the labour situation does not prevent it.

About a dozen miners were engaged in drift-mining on the leases held by the late Charles L. Queen and the Atlin Gold Mines Company, but with what success I am not in a position to say, but I believe some of these operations were quite successful. There are a few men drifting there this winter.

Spruce Creek.

This was again the banner creek of the district from the standpoint of production, although it was not quite as productive in proportion to the numbers engaged in mining as in 1917.

On the *Tobacco Box* lease and adjacent ground a few men were drifting, with much the same results as in 1917. The same remark applies with respect to the *Gladstone* lease.

On the *Peterboro* bench lease H. O. Morse, with an average force of seven men, carried on drifting operations throughout the winter of 1917-18 with satisfactory results, but closed down on May 1st because of labour difficulties. He opened up again in November and is "carrying on" throughout the winter.

On the *Lovell* group of leases Isaac Matthews still carried on through "laymen" and for some time operated on his own account, but the scarcity of labour affected this work also in the form of a diminished output, but the results per man employed ranked well up to those of former seasons.

On the *Mali* claim William Foley is still operating successfully as in former years.

On *Discovery* claim the Atlin Gold Mines Company, to which this property was assigned by J. M. Ruffner, carried on operations for part of the year, but presumably, owing to the difficulty in securing satisfactory labour in sufficient force, those operations were practically discontinued near the end of the year and its forces concentrated upon its Pine Creek holdings.

Open sluicing was carried on for a portion of the season by Smith, Conroy & Carlson, Otto Miller and partners, Marco Pini & Co., J. R. Clay, and others, with very fair results in some cases and varying success in others.

Nothing worth reporting was done at Blue canyon or Upper Spruce creek, although there were a few miners operating there.

There were about eighty people on this creek during the season, of whom about sixty were engaged directly in mining. There is a number of people on the creek this winter and drift-mining is being carried on quite successfully, the mild weather being very favourable to the prosecution of such operations.

Birch Creek.

On this creek, I regret to report, the anticipations at the close of the former season's operations were not realized, and consequently a small force of men worked throughout the season and moved about 37,000 cubic yards of gravel, besides moving pipe-lines, etc., without realizing sufficient to pay going wages; but with commendable pluck the manager, H. Peplow Pearse, intends to try it yet another season.

Boulder Creek.

On Boulder creek from fifteen to twenty men operated throughout the season.

On lower Boulder creek Charles Miller had two sets of "laymen" operating; one crew of seven men was drifting and securing very good results. The other crew of three to four men

was hydraulicking farther up the creek and also secured very fair returns. This crew closed down in October, but those who were drifting are continuing throughout the winter and are realizing handsome returns up to date.

Farther up the creek Gus. Anderson, with about four men, and J. H. Black and partner, with a like number, operated throughout the season; the former by ordinary sluicing and the latter hydraulically. The former realized very fair returns, but the latter ran into some old drift-workings and also a section of poor bed-rock, the consequence being a considerable loss of time when the water was at its best, and a resultant output not up to that of former seasons. Those parties are looking forward to better results next year.

Ruby Creek.

On Ruby creek T. M. Daulton, manager for the Placer Gold Mines Company, commenced operations on May 1st, and with a force of fourteen men continued until October 15th.

The exceptionally heavy snowfall the preceding winter resulted in an unusually heavy and excessive flow of water throughout the month of July, which prevented the usual manipulation of the water in the pits and through the by-wash for practically the whole month. This, coupled with the scarcity of labour, was responsible for a considerably decreased yardage of gravel being handled and a consequent diminished output as compared with the previous season, but notwithstanding these difficulties they advanced up-stream an average of 164 feet the full width of the pay-streak, which is 200 feet wide, and realized very satisfactory results.

This company has constructed another dam since high-water passed, which will provide an auxiliary reservoir for future operations, and which, it is expected, will conserve a sufficient additional supply of water to increase the output by 50 per cent.

Cracker Creek.

No report as to developments on Cracker creek has been presented, although I believe one or two men spent a part at least of the season on that creek.

Granite Creek.

On Granite creek some prospecting-work was performed which resulted in the location of and application for three leases on said creek. I have no definite information as to further results, but expect next season will disclose those.

Wright Creek.

On Wright creek two men operated for a portion of the season and seemed well satisfied with the results for the time spent there.

Otter Creek.

On Otter creek the Mines d'Otter Creek, under the superintendence of J. E. Moran and the general management of H. Maluin, commenced operations on March 15th, and with a force varying from a minimum of four to a maximum of ten, or an average of six, carried on until the end of October. During that period about 1,200 feet of new sluice-flume was built and the sluice-blocks renewed in the 3,500 feet of sluice previously in use. About 200,000 cubic yards of gravel was removed and about 40,000 feet of a hard-pan bed-rock which underlies the gravel in that portion of the valley was uncovered, but the genuine bed-rock was not reached and the operators believe that it lies at a greater depth and below sluicing (hydraulic) grade, and unfortunately the hard-pan was not found to carry gold in paying quantities.

There was exceptionally high water on this creek early in the season, which threatened great damage and which was only averted by strenuous effort, but after that passed there was rather a scarcity of water, as there was very little rainfall in that locality.

An experiment was made during the season which it is hoped may to some extent solve the formidable cost of riffling and maintaining long lines of sluices. This was the riffling of the sluice with heavy flat rocks held in place by sandboards and relieved by alternate rows of wooden (riffle) blocks. The experiment is reported to have been quite a success and leads those operators to believe that it will be of material value to them.

Some years ago manganese-steel plates were introduced here and worked very well, but even they will wear out, and the price of iron has advanced to such an extent that a satisfactory substitute will be hailed with delight by hydraulic miners.

Some drifting is being done this winter for the purpose of, if possible, locating genuine bed-rock and better "pay," and if they are successful in so doing operations will continue next season, provided sufficient satisfactory labour can be secured; but if better "pay" is not thus located it is probable those operations will be discontinued until conditions improve.

The average wage paid during last season was $7 a day, and this, taken in conjunction with the high cost of everything else, constrains those operators to believe that they will be justified in awaiting the return of more favourable conditions.

A fair amount of gold was won during the season, but not sufficient to cover expenses.

Nothing worth mentioning was done on upper Otter creek this season.

O'Donnel River.

On O'Donnel river a few men worked a short time on the *Gold Hill No. 3* bench lease, but the results of their operations have not been reported in any form.

On upper O'Donnel two men sank a shaft at the confluence of Feather creek and O'Donnel river and struck bed-rock at a depth of 50 feet, and just at the close of the season reported finding coarse gold in a drift which they started, leading away from the creek. They seem eager for the return of summer so that they may continue their explorations.

I have not been advised of any development-work being carried on elsewhere on this stream.

Other Creeks.

Two and sometimes three men continued prospecting on Slate creek, but only succeeded in finding sufficient gold to induce them to continue, which, I understand, is their intention as soon as climatic conditions will permit.

I have not received any reports as to the results of development-work upon the properties held on Volcanic, upper Ruby, Davenport, Lincoln, Rapid Roy, Fox, Bull, or Wilson creeks, and, in fact, with the exception of Volcanic creek, I do not believe there has been any during this year; wages were too high and labour too scarce for much attention to be paid to prospecting of that nature.

No new strikes have been reported.

Mineral Claims.

The scarcity of labour and of capital for development purposes affected the quartz-mining industry also, as was the case last year, so that very little besides ordinary assessment-work was done upon any quartz properties throughout the district, with the exception of the *Engineer* mine on Taku arm and the *Maid of Erin* and associate claims in the Rainy Hollow section.

On the *Engineer* mine the usual force of from eight to fifteen men was employed during the summer, although again (as last year) they appear to have been practically "marking time" because of the illness of Captain Alexander (the recorded owner) and the continued negotiations on the part of certain capitalists for the purchase of the property.

Those were brought to a sudden and tragic end for the time being by the loss, on the ill-fated steamer "Princess Sophia," of Captain Alexander and his wife, together with three men who had been inspecting the mine, being a mining engineer, the manager for and an agent of the prospective purchasers, and since then everything about the mine is at a standstill.

On the *Maid of Erin* the owners had from five to ten people employed from June 1st until some time in September, mining, sacking, and hauling ore from the mine to Haines, Alaska, a distance of about sixty miles, for shipment to a smelter. They succeeded in shipping about 26 tons, and demonstrated the possibility of doing so even under the very adverse and trying conditions in the matter of roads and transportation facilities which exist.

The owners of this property, which contains a deposit of high-grade copper ore, believe that if the wagon-road which runs from Haines to the mine was put in such condition as to permit of the successful operation thereon of a Cleveland tractor (of which they have one on the ground) they could ship the product of the mine at a profit, and they are looking to both the Provincial and the Alaskan Governments to put the road in such condition.

Nothing was done towards developing the coal-deposits in the district, nor did the contemplated exploitation of the hydromagnesite-deposits eventuate.

OFFICE STATISTICS—ATLIN MINING DIVISION.

Free miners' certificates (individual)	353
Free miners' certificates (company)	4
Placer records	12
Placer rerecords (representing 241 claims)	226
Leases located	8
Leases issued	0
Leaves of absence (representing 140 claims)	31
Filings	2
Bills of sale (placer)	25
Bills of sale (hydraulic)	42
Bills of sale (mineral)	9
Mineral records	19
Certificates of work	119
Filings	2
Crown grants issued	2
Gold reported (individuals)	$131,010 00
Gold reported (companies)	105,623 00
Total	$236,633 00
Royalty paid (individuals)	$ 1,661 05
Royalty paid (companies)	1,443 10
Total	$ 3,104 15

Revenue.

Land revenue	$ 4 00
Water revenue (rentals)	1,403 00
Free miners' certificates (individual)	1,705 25
Free miners' certificates (company)	405 00
Mining receipts (lease rentals)	2,945 00
Mining receipts (lease applications)	160 00
Mining receipts (other sources)	2,537 30
Mineral-tax (royalty)	3,104 15
Receipts from all other sources	8,975 35
Total	$ 21,239 05

STIKINE AND LIARD MINING DIVISIONS.

REPORT OF H. W. DODD, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining operations in the Stikine and Liard Mining Divisions of Cassiar District for the year ending December 31st, 1918.

Although the office statistics show an increase over the previous year, there has been no marked activity in the mining industry, brought about by the scarcity of labour caused through war conditions.

PLACER-MINING.

On Dease creek Hanimann & Ruepp were engaged doing development on the *Kangaroo* lease. On other creeks in this vicinity very little was done.

On McDame creek a few men under Amos Godfrey carried on development on the *Princess May* hydraulic properties.

QUARTZ-MINING.

Work sufficient to cover assessment was carried out on the principal claims, whilst acreage-tax was fully paid up on all claims held on the Unuk river.

On the Iskut river Crown grants were issued on the following: *Red Bluff*, *Red Bird*, *Mermaid*, and *Homestake*, making thirteen Crown-grant claims in all in this group, held by F. E. Bronson and associates, of Wrangell, Alaska.

OFFICE STATISTICS—STIKINE AND LIARD MINING DIVISIONS.

Revenue collected from free miners' certificates	$ 262 75
Revenue collected from mining receipts	880 20
Revenue collected from acreage-tax, mineral claims	220 50
Revenue collected from other sources	4,116 18
Total	$5,479 63

SKEENA DISTRICT.

SKEENA AND BELLA COOLA MINING DIVISIONS.

By J. H. McMullin, Gold Commissioner.

I have the honour to forward you herewith office statistics for the Skeena and Bella Coola Mining Divisions. The annual report of the Resident Engineer, Geo. A. Clothier, fully covers these Divisions and I have nothing to add to his report.

I also enclose report received from the Mining Recorder of the Queen Charlotte Mining Division and office statistics forwarded by the Mining Recorder of the new Nass River Mining Division.

Office Statistics—Skeena and Bella Coola Mining Divisions.

Free miners' certificates (individual)	596
Free miners' certificates (company)	5
Free miners' certificates (special)	2
Mineral claims recorded	253
Placer claims recorded	5
Certificates of work issued	424
Bills of sale, etc., recorded	77
Filings	33
Certificates of improvements recorded	17

Revenue.

Free miners' certificates	$3,258 00
Mining receipts, general	2,987 20
Total	$6,245 20

NASS RIVER MINING DIVISION.

This is a new Mining Division created by Order in Council dated August 12th, 1918, given below. The territory comprised therein was formerly the northern part of the Skeena Mining Division.

The recording office of the new Division is at Anyox, with H. Andrew as Mining Recorder, and is under the jurisdiction of J. H. McMullin, of Prince Rupert, as Gold Commissioner.

The following is the official description of the Nass River Mining Division:—

The Nass River Mining Division be created to include the following defined boundaries, viz.: Commencing at a point on the western boundary of Omineca Mining Division where it is intersected by the height of land forming the watersheds between the Nass and Skeena rivers; thence south-westerly along the said height of land to a point where it is intersected by the height of land separating the watershed of the Kinnomax river on the north from the watershed of Khutzeymateen inlet on the south; thence along the latter height of land to a point on the said inlet immediately south of Somerville island; thence westerly across said inlet and along the centre of the channel separating the said island from the mainland, and continuing westerly to a point on the International Boundary-line immediately south of Wales island; and so as to include Wales island, Pearce island, and the said Somerville island in Nass River Mining Division; as well as that portion of the Skeena River Mining Division lying north of the hereby established boundary between the commencing point and the International Boundary.

OFFICE STATISTICS—NASS RIVER MINING DIVISION.

(For period extending from September 1st, 1918, to December 31st, 1918.)

Free miners' certificates (individual)	11
Mineral claims recorded	36
Certificates of work issued	94
Bills of sale, etc., recorded	36
Filings	7

Revenue.

Free miners' certificates	$ 37 00
Mining receipts, general	453 50
Total	$490 50

QUEEN CHARLOTTE MINING DIVISION.

BY J. L. BARGE, MINING RECORDER.

I have the honour herewith to submit my annual report for the Queen Charlotte Mining Division for the year ending December 31st, 1918.

PLACER LEASES.

Seventeen placer leases have been issued during the past year—five on the North beach; five at Rose spit, north end of Graham island, under the management of A. L. Flynn; and on the east coast, six under the management of R. R. Smith and one to Percy Sharpe.

These gentlemen are still very optimistic regarding their claims, though conditions have been very adverse for the development during the past year of strenuous war-work. Mr. Flynn has been compelled to cut down operations to the lowest possible limit owing to the lack of transportation facilities. The logging operations under the Imperial Munitions Board having first claim to all available cargo-space, Mr. Flynn found it impossible to get in the necessary supplies. This applies also to R. R. Smith, and in greater measure, as his claims lay farther down the east coast; in addition to which, Mr. Hascoe, partner with Mr. Smith, and inventor and owner, of the special hydraulic machinery now installed, was drafted into the army of the United States.

With the war at an end and the consequent release of labour and supplies, renewed activity is looked for.

MORESBY ISLAND.

Tasu Group. Situated on the west coast of Moresby island. Operations on these claims, which during 1917, I understand, shipped 400 tons of ore to Tacoma for the copper and iron values, of which I have received no statement, had to close down owing to the exigencies of the war.

JEDWAY.

Ike Thompson, Deputy Mining Recorder, Jedway, reports considerable activity throughout his territory.

The *Producer* mine, under bond to a Seattle syndicate and under the management of A. J. Cole, has a staff of eight men installing a hydraulic compressor plant, 400 feet of 10-inch pipe conveying the water; 250 feet will be driven to tap ledge 100 feet below bottom of 60-foot shaft.

A. Heino continues to make small shipments from the Copper islands, and several other owners have made small shipments, the returns from which are not yet available.

Wild & Campbell have a shaft 30 feet deep and a very hopeful showing on their several claims.

Ike Thompson has a good dump of ore out, showing 10 per cent. copper.

H. McEachern, on the *Hope* group, has uncovered a large body of good ore.

Ore bodies on the *McMullan* group are also being traced out.

Ikeda Mines, Ltd.

Owing to the prevailing shortage of labour very little active work has been done on these properties; however, the ore shipped to the Granby smelter, Anyox, B.C., for the first ten months of the year was 193 tons. Total contents: Copper, 57,404 lb., value $12,850.04; silver, 695.74 oz., value $680.75; gold, 51.45 oz., value $1,029.10. A later shipment of about 15 tons of high-grade ore containing about 17 per cent. copper, $7 silver, and $5 gold a ton; and one of about 150 tons of ore containing about 7 per cent. copper, $1.50 silver, and $2.50 gold a ton, returns for which are not yet available.

Lockeport.

Shuttle Island.—In the early part of the year a logging camp started operations on this small island, just off the east coast of Moresby island and in Darwin sound, a few miles south of Lockeport, resulting in the discovery on the beach of coarse free gold, several small nuggets being picked up. One placer claim and twenty-three quartz claims were recorded in consequence.

The Imperial Munitions Board soon closed down this logging camp, and most of the locators were sent elsewhere. No doubt these claims will be exploited now that the men have been released from the camps.

Skidegate.

South Easter Group.

The closing of 1918 terminates the sixteenth month of active development-work on the *South Easter* group of claims. The work is being done by the Northern Customs Concentrators, Limited, of Cobalt, Ont., under the name of the South Easter Mining Company. A 30-horse-power oil-driven compressor, hoist, and drills have been used in carrying on the work. A continuous line of gold-bearing quartz-outcrops 6 to 8 feet in width extend practically the length of the claim. Near one of the showings a vertical shaft 100 feet deep was sunk; at 50 feet a crosscut intersected the main vein, called No. 2, and 125 feet of drifting was done on this lead. The vein continued strong, averaging 6 feet in width throughout this drift. Some further crosscutting and drifting on this level, amounting to 115 feet, gave three other well-defined veins averaging 4 feet in width, but carrying low values where cut.

On the 100-foot level 350 feet of drifting and raising on the No. 2 vein has indicated an ore-shoot. The continuation of one drift to develop this ore-shoot is in progress. Another drift along this vein in the opposite direction is under way to develop other ore-shoots farther up on the property as indicated by the large surface showings.

The gold occurs associated with galena, and in the clean quartz in very fine particles. This occurrence gives to the high-grade ore the appearance of being stained with patches of yellow mud, but under a glass the individual particles, metallic lustre, and characteristic colour are revealed. One to two ounces of silver and small percentages of lead and copper are associated with the ore. With the return to normal conditions, an increase in operations is contemplated.

Office Statistics—Queen Charlotte Mining Division.

Free miners' certificates issued	162
Mining claims recorded (quartz)	65
Mining claims recorded (placer)	2
Certificates of work	69
Bills of sale and records entered	8
Placer leases issued	17
Placer leases applied for	2

Revenue.

Free miners' certificates	$ 662 75
Mining receipts	996 25
Traders' licences	285 00
Firearms licences	155 00
Police Court fines	220 00
Marriage licences	40 00
General receipts	6 50
Poll-tax	15 00
Total	$2,380 50

PORTLAND CANAL MINING DIVISION.

REPORT BY P. S. JACK, MINING RECORDER.

I have the honour to submit herewith office statistics for the Portland Canal Mining Division for the year ending December 31st, 1918.

George A. Clothier, Resident Engineer, in his report on this Division, has fully reported on the mining operations during 1918.

OFFICE STATISTICS—PORTLAND CANAL MINING DIVISION.

Free miners' certificates	109
Mineral claims recorded	181
Certificates of work issued	270
Bills of sale, etc., recorded	79
Filings	37
Certificates of improvements recorded	9

Revenue.

Free miners' certificates	$ 596 75
Mining receipts, general	3,510 70
Total	$4,107 45

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NORTH-EASTERN DISTRICT (No. 2).

Report by John D. Galloway, Resident Engineer.

GENERAL REMARKS.

Under the provisions of the "Mineral Survey and Development Act" of 1917, the four Mining Divisions of Omineca, Cariboo, Quesnel, and Peace River were made to constitute the North-eastern Mineral Survey District, with headquarters for the Resident Engineer at Hazelton. A general description of the geographic features of the district, together with a bibliography of all published reports on the geology and mining features of the district, is given in the Annual Report of the Minister of Mines for 1917, so that it is unnecessary to repeat it this year.

In the 1917 Annual Report different portions of the North-eastern District were denoted under different headings as "sub-districts." This year the subdivisions have been extended, and the term "section" is used as more suitable than "sub-district."

The North-eastern District consists of the four Mining Divisions, as stated before, and these Divisions are subdivided for the purpose of this report as follows:—

Omineca Division—Skeena River Section; Hazelton Section; Telkwa Section; Sibola Section; Manson Section.

Cariboo Division—Fort George Section; Quesnel Section; Barkerville Section.

Quesnel Division—Horsefly Section; Keithley Section; Quesnel River Section.

Field-work in this district can only be commenced about the beginning of June and continued until the end of November, as in the higher elevations, where nearly all the claims are staked, there is snow on the ground for six months in the year. For this reason the Resident Engineer, during the first five months in 1918, was in the Victoria office engaged in preparing the report of the previous year's work and assisting in the compilation of the Annual Report of the Minister of Mines.

More attention was given to the Cariboo and Quesnel Divisions this year than in 1917, with the result, as the district is a large one, that less field-work was carried out in Omineca Division than in the previous year. A reconnaissance in the Peace River Division was contemplated for the season, but lack of time prevented this work being effected.

The lode-mineral production for 1918 declined as compared with 1917, and this with a lessened placer-gold output makes the total mineral-output for the North-eastern District less than in the previous year.

The following table shows the mineral production of the North-eastern Mineral Survey District for the year 1918:—

	Omineca.		Cariboo.		Quesnel.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer	400 oz.	$ 8,000	3,000 oz.	$60,000	1,000 oz.	$20,000
Gold, lode	985 oz.	20,330	.....	.....	.....	.....
Silver	84,125 oz.	77,366	.....	.....	.....	.....
Lead	123,568 lb.	8,242	.....	.....	.....	.....
Copper	643,843 lb.	158,578	.....	.....	.....	.....
Zinc	313,112 lb.	21,730	.....	.....	.....	.....
Miscellaneous materials	.....	3,900	.....	2,500	.....	1,000
Coal	.....	2,350	.....	.....	.....	.....
Total values	.....	$300,496	.....	$62,500	.....	$21,000

Total value of mineral production, North-eastern District, $383,996.

It will be noted that in the above table Peace River does not figure at all; so far as is known, no mineral production has ever been officially recorded from this Division. Prospecting for placer gold has been done on the Peace river and tributary streams, and probably small amounts of placer gold have been taken out in this way; it is certain, however, that this has

never amounted to more than a few hundred dollars in a season. As a hopeful sign for the future, it may be noted that fifteen dredging leases were taken up in this Division during the summer of 1917. Systematic prospecting of these leases, to test them for dredging possibilities, will be carried out next year by the lessees, Wadley & Galbraith.

The copper-output of the district during the past three years has been chiefly from the *Rocher Déboulé* mine, and this year the output from this mine has been less than in former years.

The zinc and most of the silver and lead output comes from the *Silver Standard* mine; this property is now in good shape to make an increased production in the future.

The hydraulic mines in the vicinity of Barkerville, which annually produce the greater part of the gold-output of the Cariboo District, had a poor year in 1918, which served to further lessen the year's production. Spring freshets took off the winter's snow too quickly, and a long dry spell following caused the mines to be short of water most of the season, with the result that a smaller yardage than usual was handled. The production from these mines is almost directly proportional to the water-supply, and the 1918 season was a bad one.

Mining in the Province practically commenced in this district in the working of the phenomenally rich placer-gold creeks of the Cariboo in the early sixties. The gold production of the Cariboo was large for a few years, and then, like all placer-fields, rapidly declined; now the annual production, which comes mainly from a few hydraulically operated properties, is comparatively small. In the last twenty years much money has been expended in the Cariboo in expensive plants to work the deposits of low-grade gold-bearing gravels which could not be worked by the old-time methods. With few exceptions, these enterprises have been failures; lack of engineering skill and adequate preliminary testing of the ground have undoubtedly been the chief reasons for many of these failures. The Cariboo District, however, still has many possibilities for the large-scale working of its low-grade gravels. The great handicap in many instances is lack of water for hydraulic operations, while, in most cases, to lay on an adequate supply of water means a big capital investment for ditches, flumes, and pipes. In the future some areas may be worked by dredging.

Many attempts have been made in the past to mine quartz veins in the vicinity of Barkerville and Stanley, but none have proved successful; many of these enterprises were badly conceived and never had a chance to make good. Repeated failures have given the district a bad name as regards lode-mining, with the result that it has been difficult in recent years to interest capital in any new properties or showings. There is now, however, some renewed interest in the possibilities of gold-quartz mining in the Cariboo.

During the last two years the production of gold throughout the world has seriously declined, due to the economic conditions of high prices for labour and supplies, while the gold produced remained at the same value. In other words, the gross revenue of a gold-mine remained the same, while the operating expenditure was greatly increased, so that the margin of profit decreased, or in some instances vanished, with the result that the mines had to close down. The Cariboo District has suffered from this cause, and also so many men left for active service in the war that the number of individuals placer-mining in a small way was materially less than in former years; and the shortage of labour handicapped larger-scale operations. Now that the war is over this adverse economic condition against gold-mining may be expected to gradually adjust itself. As one result, more interest will be taken in the acquiring and developing of gold properties.

It may be expected, therefore, that with the return of many men from the Front and the renewed interest now being taken in gold-mining, the Cariboo District may again secure the attention that it deserves.

At present the only important active lode-mining area in the North-eastern District is the territory along the Skeena and Bulkley rivers, including the Bulkley and Babine mountains. For some years before the construction of the Grand Trunk Pacific Railway, claims had been staked in this area and some attempts at mining had been made along the lower Skeena river; but it was not until the completion of the railway in 1914 that any great headway was made. Considerable progress was made in 1914 and 1915, but in the last three years mining activity has not progressed as rapidly as had been hoped.

The chief cause of this can be ascribed to conditions arising out of the war. While it is true that metal prices have been high, this has mainly stimulated mines actually producing and

has not induced the development of new properties, except where quick returns were in sight. On the other hand, the scarcity, inefficiency, and high cost of labour, the high cost of mining supplies, especially powder and machinery, and the scarcity of capital for speculation has had a retarding effect on the development of new mining properties. It may be expected, however, that the return to normal conditions will cause greater activity in this district during 1919.

The district has as yet few productive mines, although undeveloped prospects and partially developed properties are numerous.

Considerable interest was shown in the coalfields of the Telkwa Section during the year. The high cost of fuel-oil and the steadily increasing price of coal on the Pacific Coast are conditions which have aroused interest in undeveloped coalfields. During the year the Grand Trunk Pacific Railway, on the division from Prince George east, changed from oil-burners to coal-burning locomotives, and it is quite possible that if a suitable local supply was available the division from Prince Rupert to Prince George would also be equipped with coal-burners.

Production of coal in a small way was started late in the fall from the Telkwa Collieries, situated four miles from Telkwa. By the end of the year an output of about 40 tons a day was being shipped, mainly to Prince Rupert.

In the North-eastern Mineral Survey District many areas contiguous to the Grand Trunk Pacific Railway have been partially prospected and many claims staked, but careful examination, such as has been carried out in some of the older camps in British Columbia, has not yet been done. In addition, there is a great deal of country, both north and south of the railway, which is as yet quite unprospected, but in which the general geological conditions are favourable for the occurrence of economic minerals. It is to be expected that the return of many men to the country now that the war is ended will result in a general revival of prospecting. Undoubtedly many of the prospectors who enlisted will return to their old occupation, while the free, adventurous life of the prospector, with its promise of possible spectacular returns, will make a strong appeal to many returned soldiers who before the war had led indoor lives. The North-eastern Mineral District should secure a considerable number of these returned men who are desirous of following such a life.

OMINECA DIVISION.

Skeena River Section.

This section includes the territory contiguous to the Skeena river and its tributaries, between Copper City and Skeena Crossing. The more important localities in which claims have been staked are: Vicinity of Usk, Kleanza creek, Copper river, Chimdemash creek, St. Croix creek, Legate creek, Fiddler creek, and Skeena mountain.

In the 1914 Annual Report there is a report by W. M. Brewer on this section which covers most of the more important properties. Since then the Annual Reports contain further information.

Kleanza and Legate creeks were not visited this year owing to lack of time, although a number of prospectors were busy all season on Legate creek. A description of the more important claims on these creeks can be found in last year's Annual Report. The *Fiddler* group, on Fiddler creek, was described in detail in the 1916 Report, and since that time no further work has been done.

Emma Group.

This property, consisting of the *Emma*, *I.X.L.*, and *Boot Jack* claims, is situated on the east bank of the Skeena river about half a mile north from the Government ferry across the river from Usk, a station on the Grand Trunk Pacific Railway. The property is Crown-granted and is owned by the Skeena River Mining Company, the control of which is held by Mrs. Clifford, of Vancouver. The claims were worked about twenty years ago, since when no work has been done. The property is well situated for economical working, being close to the railway.

At a point 500 feet above sea-level, or 200 feet above the Skeena river and 1,300 feet distant from its east bank, there is outcropping a quartz vein which strikes easterly up and down the mountain. This vein varies from 1 to 4 feet in width, and in places is mineralized with chalcopyrite, bornite, and pyrite occurring irregularly disseminated in the quartz; oxidation has in places produced the copper carbonates, malachite, and azurite. The vein is well defined and generally has a talc gouge on both walls. The enclosing country-rock is a fine-grained diorite porphyrite, in places somewhat schistose.

Just below the original outcrop of the vein an adit-tunnel has been driven on the vein for a distance of 170 feet. For the first 65 feet the tunnel is closely timbered and the vein cannot be seen, but beyond this to the face the vein is seen to be continuous throughout, and averages about 3 feet in width, having a dip of about 45 degrees to the east.

The main values are said to be in gold, apparently occurring with the copper and iron sulphides. A sample of the quartz free from sulphides on assay only returned traces of gold and silver. A sample of the mineralized quartz by W. M. Brewer in 1914 returned: Gold, 0.3 oz.; silver, 1.9 oz.; copper, 3.3 per cent.

This vein is reported to outcrop again 1,000 feet up the hill, where an open-cut shows it to be from 6 to 10 feet wide, consisting of quartz mineralized with bornite, pyrite, and copper carbonates. A representative sample by W. M. Brewer gave: Gold, 0.02 oz.; silver, 8.04 oz.; copper, 6 per cent. The vein on this property is promising if it can be shown to carry appreciable pay-shoots of the sulphide ore.

Old Hickory Group. This group of eight claims, owned by A. J. Kelch, is situated close to the Skeena river on the opposite bank from the village of Usk. The showings are distant about a mile from the river in a small hill rising above the general level of the river-valley. Mr. Kelch has a good cabin here and a nice garden with plenty of small fruits growing in it. The formation at this point consists of volcanic rocks, mainly andesites and diabase. The vein (so called) is apparently a felsitic dyke striking cleanly through the volcanics in a north-easterly and south-westerly (magnetic) direction. This dyke is sparingly mineralized with chalcopyrite and bornite. Low gold and silver values are associated with the copper contents. The dyke-rock forms the gangue, through which there is some development of quartz and epidote.

A tunnel has been driven in some distance on the dyke, but the amount of copper mineral showing in the tunnel or taken out in the work is quite small in amount. Much larger ore-shoots would need to be found before the property would be of possible economic value. Above the tunnel and going up the hill the dyke has been exposed by several open-cuts, but nowhere is there any appreciable quantity of ore developed. There are other indications found on the hill in the shape of copper-stain, and further prospecting might find a more promising place to work than the tunnel showing.

Cordillera Group. This property, situated close to Usk and owned by the Kitsalas Mountain Copper Company, was fully described in last year's Report, and there is but little to add this year. Work was carried on during the summer and fall with from four to six men, but later in the year work was stopped and will not be resumed until next spring. Driving of the crosscut tunnel started in 1918 was continued until it had intersected the main vein and for a further distance of 50 feet. The point of intersection is about 200 feet along the strike, from where the surface incline was sunk on the vein. Surface cuts and the incline shaft show the quartz-filling to be mineralized with bornite and chalcocite, and in places free gold associated with the copper minerals, but where cut in the tunnel the quartz has practically no sulphides in it, and consequently little or no values. It is expected, however, that by drifting on the vein towards the surface mineralized outcrops, an ore-shoot carrying sulphides will soon be entered. It has been pretty well proved that the unmineralized quartz carries little or no gold.

In driving the crosscut tunnel, at a point 121 feet from the portal, a vein, which apparently does not outcrop on the surface, was cut and then drifted upon for 122 feet to the south, where a winze was sunk to a depth of about 15 feet. In the winze the vein widens out to 3 or 4 feet, consisting of, roughly, one-third quartz and two-thirds schistose gangue. Bornite and chalcocite occur through the quartz, while free-gold specimens are quite often found. This vein, which occurs in schistose rock, is faulted along the roof of the drift. As the indications are encouraging, it is probable that the first work on the property next season will be to continue development of this vein, either by drifting or sinking on it.

Lucky Luke. This property adjoins the *Cordillera* to the south, and is owned by L. E. Moody and Richard Lowrie. It is favourably situated, being only a short distance from the railway and at about 1,000 feet higher elevation. The vein occurs in schist and is well defined, being from 1 to 2 feet wide. The gangue is schistose rock with a certain amount of quartz scattered through it, often in bands. The sulphides occurring in the vein are bornite, chalcopyrite, and a little pyrite. The presence of copper carbonates and iron

oxides indicate the usual surface oxidation. Specimens showing free gold occur frequently, the colours of gold, as a rule, being quite small and associated mainly with the bornite.

A tunnel has been driven 55 feet on the vein, the strike of which is a little west of north and the dip about 60 degrees to the east. In places the vein is well mineralized with the copper minerals occurring in bands and bunches. The showing at the face of the tunnel is good and should encourage the further driving of the tunnel.

A sample of selected ore from a 5-ton dump at the mouth of the tunnel assayed: Gold, 2.48 oz.; silver, 1.52 oz.; copper, 11 per cent. A considerable part of the vein is white quartz, but a pay-streak of this rich ore comes in in places.

About the end of the year a lease on the property was obtained by three men, who erected a cabin on the claim and intend working on the property all winter.

Hazelton Section.

Rocher Déboulé Mountain.

Rocher Deboule.

During the last three years the *Rocher Déboulé* mine has been the most important one in the district, but the exhaustion of the developed ore-bodies in the upper levels caused a decreased production in 1918. The mine was closed down in October, the reason given being: "It was thought best to suspend operations until such time as conditions become normal again." This property has been shipping since April, 1915, and up to the end of 1918 had produced 39,833 tons of ore, containing 4,214 oz. gold, 62,865 oz. silver, and 5,746,306 lb. copper.

In the 1914, 1916, and 1917 Annual Reports will be found detailed descriptions of the mine, its ore occurrences and development, so that repetition of this is unnecessary here. A brief summary, however, will be given.

The *Rocher Déboulé* mine is situated on the north-west side of Juniper creek, a short distance below the head of the creek. It is connected by a good wagon-road to Skeena Crossing, on the Grand Trunk Pacific Railway, ten miles distant. The ore is transported to Tramville on the railway by a 4½-mile tramway system consisting of a surface tram and an aerial tram in two separate sections. A hydro-electric plant on Juniper creek supplies power for the mine, in addition to which a 20-horse-power distillate-engine has been installed at the mine as an auxiliary when the water is low. Comfortable bunk-houses, offices, and all necessary buildings and appliances for a working force of 100 men have been erected in the valley of Juniper creek. The office is at an elevation of 4,000 feet, while the upper and first mine-workings are up the hill about 1,200 feet above. An incline power tramway from the power-house to the 300-foot crosscut level was installed for taking men and supplies from the camp up to the mine.

There are four veins traversing the hillside which are approximately parallel, striking N. 80° E. (mag.) and dipping from 45 to 85 degrees to the north. The vein which first attracted serious attention and has been most developed is the one cropping out highest on the hill and known as the No. 4 or main vein.

These fissures have been formed by shearing, which as a rule produced a crushed zone rather than an open fissure. The deposition of ore in the vein was therefore mainly a replacement process whereby the crushed granodiorite was replaced by metallic minerals and gangue-matter. The veins are therefore of the sheared-zone replacement type.

The metallic minerals present are chalcopyrite, pyrite, pyrrhotite, arsenopyrite, galena, zinc-blende, and tetrahedrite. The gangue consists of altered granodiorite, hornblende, quartz, calcite, and siderite. The main important mineral is chalcopyrite, although in one vein the galena-tetrahedrite content is appreciable.

After some preliminary prospecting had been done, the mine was opened up by a 650-foot crosscut tunnel known as the 300 level, which intersected the main vein. From this working four rich ore-shoots were worked out practically to the surface, and by underhand stoping for varying distances from 50 to 175 feet down below the level. A winze was sunk from this level for 200 feet and the vein drifted on at this 500-foot level. The known ore-shoots did not go down this far and no new ore-shoots of importance were found. This level was therefore abandoned.

A comprehensive development plan was laid out in 1916, when the low level, or 1,200-foot level was started. This crosscut tunnel, the portal of which is 900 feet below the 300-foot level,

has been driven in 3,100 feet, cutting three of the veins and a fracture which is very probably the main vein. No. 1 vein, which is an unimportant one, was cut where the backs on it are 180 feet; No. 2, 460 feet; No. 3, 1,050 feet; and No. 4, 1,180 feet to the 300-foot level. Considerable doubt existed as to whether the main vein had been cut, and the tunnel was continued for some distance past the fissure, which was intersected at about the right place for this vein. On the assumption later that this fissure was the main vein, it was drifted on in both directions, but no ore-shoots were found. An incline raise from the 1,200-foot level to the 500-foot level, following as closely as possible the course of the main vein, has been projected in order to explore this vein between the two levels. A start was made on this raise, but it was only put up a short distance when the mine was closed down. It is hoped that by connecting these two levels by this raise and then crosscutting the vein at intervals further ore-shoots may be discovered. Some drifting was also done on the No. 3 vein, where some milling-ore was discovered.

On the No. 2 vein a good shoot of rich ore had been discovered near the surface in a prospecting-tunnel, and much ore was taken out on this level, known as 1,002. Drifting on the 1,200-foot level on this vein disclosed additional high-grade ore, and this vein has now been opened up for 1,500 feet or more. For most of this length the vein contains milling-ore, but only one good shoot of shipping-ore was discovered. All the ore shipped in 1918 and part of that in 1917 came from this vein. Shortly before closing down a winze was put down on this No. 2 vein from the 1,200-foot level which shows a shoot of shipping-ore averaging about 2 feet in width.

No. 2 vein is mineralized in part with silver-lead minerals and in part with copper-iron minerals, the latter being the more important. In many places these two mineral types occur in separate bands in the vein, but occasionally they are intermingled. Where galena and tetrahedrite occur good silver values are obtained. The lead content of this vein as a whole is quite unimportant, but the average gold and silver contents are higher than in the copper ore of the main vein.

With further development this vein, which runs from 2 to 8 feet in width, may provide a sufficient tonnage to keep a small mill running. In addition to this, other substantial shoots of shipping-ore can be expected.

New Hazelton Gold-Cobalt Co.

This property was worked continuously throughout the year with a small force of men. The 1916 and 1917 Annual Reports contain reports on the property, giving details of the veins, development, etc., up to the beginning of 1918. The property is situated on the western slope of Rocher Déboulé mountain, five miles from Carnaby. The camp is at an elevation of 4,200 feet and the upper tunnel 5,655 feet. Until late in the fall Dalby Morkill was superintendent when Duke Harris took charge of the work. The upper tunnel, which is a drift on the vein, was in 712 feet when work was stopped some time ago. At 40 feet from the portal a stope from the tunnel was put up, extending 30 feet in length and 40 feet upwards, tapering at the ends. At 370 feet from the portal a raise was put up 100 feet on the vein, and from this level a drift run 84 feet to the west. At 450 feet from the portal a winze has been put down 22 feet.

The winze and raise both show the vein to carry ore in bunches and bands varying from 3 to 18 inches in width. This ore is mainly arsenopyrite carrying gold values, together with more or less molybdenite. While the mineralization in the vein is very spotted, some ore could be stoped out.

A lower tunnel was started 250 feet below the main tunnel; it was driven as a crosscut for 75 feet and then as a drift on the vein. On November 1st this drift was in 149 feet and work was being continued. Throughout this working the vein carries a shoot of ore, more or less continuous, and varying in width from 6 to 18 inches. This ore is a mixture of sulphides and arsenides of iron and cobalt and some molybdenite.

The pure arsenical iron-cobalt ore in this vein carries from 2 to 5 oz. of gold to the ton and varying percentages of cobalt up to 7 per cent. The molybdenite content of the vein is quite variable. During the year a car-load of gold-cobalt-molybdenum ore which came from the upper tunnel was shipped to the concentration plant of the Mines Branch at Ottawa. The car contained 53,288 lb. dry weight, and the analysis on it was: Gold, 1.24 oz.; MoS_2, 1.40 per cent.; MoO_3, 0.18 per cent.; cobalt, 1.12 per cent.; nickel, 0.60 per cent.; arsenic, 8.98 per cent. The shipment was divided into three lots and treated in different ways in order to find a suitable process for concentrating the ore. The report submitted on the testing says: "The object of the test-

work was to concentrate the values in the ore and also obtain a separation of these values as far as practical. As the cobalt, nickel, arsenic, and gold values were intimately associated, it was feasible to concentrate these by water-concentration and also to obtain a separation and concentration of the molybdenite values by flotation. . . . The actual recoveries on this car-load of ore were as follows:—In table concentrates: Cobalt, 72.6 per cent.; nickel, 87.5 per cent.; arsenic, 84.9 per cent.; gold, 83.5 per cent. In flotation concentrates: Molybdenite, 54.4 per cent. These recoveries should be improved upon in practice where a closed circuit could be maintained and the losses due to handling and slime-overflow would be reduced to a minimum."

A car-load of ore was taken out of the stope in the upper tunnel and was packed down to Carnaby on the railway, but it is believed this was not shipped before the end of the year. The main value in this ore is gold, and it will probably be shipped to some British Columbia smelter. It is expected to assay between $60 and $80 a ton in gold. Any cobalt contained would not be recovered if smelted within the Province.

During the summer work was commenced on another vein on the property, which is supposed to be a continuation over the ridge of the main *Rocher Déboulé* vein. Some work was done on it a few years ago before the present company owned the preperty, but without any definite results.

The outcroppings of the vein are very much leached and oxidized and occur in broken ground and talus material. Owing to these conditions it is difficult to prospect the vein. A tunnel has been driven as a crosscut for 25 feet and a further 93 feet along the supposed strike of the vein. The ground is all broken, but contained bunches of vein material showing copper-stain. Work was being continued to drive ahead this tunnel, and it seemed as if a solid formation would soon be reached where the vein may be found properly in place.

During the year a 1,000-foot 2-bucket tram was erected from the portal of the upper tunnel down the hill. From the terminal of this tram the ore is packed down to the railway. A blacksmith-shop was built and things put in shape for continuing the work all winter.

Delta Copper Co. The holdings of this company comprise the *Delta* and other groups of claims and a control of the stock in the company owning the *Highland Boy;* all these claims are on Rocher Déboulé mountain, lying to the east of the *Rocher Déboulé* mine. The financial obligations involved in acquiring this property were such as to impose some difficulties on the company, with the result that funds were not available to carry on active development and mining. Not much work has been done, therefore, on the property during the last two years.

At the present time, however, the company is reported to be in good shape, with the property practically paid for and funds in hand for settling outstanding liabilities and providing for further work. Late in the fall a few men were put to work, but it is not expected that much will be done before the spring of 1919. The property has been described in detail in the Annual Reports of the Minister of Mines for 1916 and 1917.

Golden Wonder. Intermittent work in a small way was carried on at this property during the first half of the year with satisfactory results. Owing to the difficulty of obtaining miners and the general unsatisfactory conditions for development mining, the work was stopped. It is expected development will be resumed next spring.

Cap Group. The driving of a development tunnel on this property was started in 1917 and continued during the first two months of 1918. Work was then stopped and nothing further has been done since.

Black Brince Group. This group owned by Barney Halloran and William Thompson, is situated near the head of Mud creek on the north-eastern side of Rocher Déboulé mountain. From the Hazelton-Telkwa road a trail six miles in length goes up Mud creek to the claims. In the basin at the head of the creek a small cabin has been built; the workings of the claims lie up the hillside some distance above the cabin. The main vein on the property is a shear zone in granodiorite of varying width up to 10 feet. Where wide the vein consists of parallel fractures with unaltered granodiorite lying between. Bands of quartz appear in places in the vein, but elsewhere the gangue material is altered granodiorite. Metallic minerals are only present in very small quantity. Pyrite was the most abundant sulphide present in the ore, but on the surface it has been pretty well oxidized to limonite, with the result that the whole vein is rusty and iron-stained. Small quantities of chalcopyrite were noted, but not in sufficient amount to be of importance. Molybdenite and

wolframite occur in the gangue, but very sparingly distributed. The property has been considered to be of value on account of the wolframite content in the vein-filling, but average assays show that, at least on the surface, the wolframite content is not of commercial importance.

The vein, which strikes N. 67° W. and is well exposed running up the hillside, which has a slope of at least 45 degrees, crops out right up to the summit of a small ridge, and then continues nearly level for a few hundred feet to where it disappears under rock-slide. Beyond this in a bluff a well-defined iron-stained fissure can be seen which is probably a continuation of the vein.

A number of open-cuts and short tunnels have been made along the strike of the vein to prospect the ore occurrences. At an elevation of 4,900 feet a small opening shows a band of oxidized vein material 16 inches wide, which, however, does not show appreciable mineral content. At 4,940 feet elevation a big cut shows a width of about 15 feet between extreme walls. The vein here consists of a number of streaks of quartz, the widest of which is 1 foot, and bands of granodiorite lying between. Six stringers totalling 4 feet in width in this cut were sampled, and on assay gave: Gold, trace; silver, 0.4 oz.; tungsten, trace. The vein-filling in these stringers is considerably leached, with some limonite and copper-stain through it. Small amounts of pyrite and chalcopyrite were noted.

At 4,965 feet elevation a tunnel has been driven 12 feet. At the face the vein proper is 2½ feet wide, with 14 inches of rotten quartz in the centre. The vein-filling is oxidized and carries black and red oxide of iron, sericite, and other decomposition products, with a 3-inch layer of gouge on the wall. A little molybdic oxide and molybdenite were noted. A sample from this opening only returned a trace of tungsten.

On top of the ridge there are three small cuts on the vein all close together. The best showing on the property is in the most southerly of these cuts. The vein is 3 feet wide, with 1 foot on the hanging-wall which is more mineralized than the remainder. A sample across the vein assayed: Gold, 0.06 oz.; silver, 0.6 oz.; tungstic oxide, 2.56 per cent.

A small cut 25 feet north of the last one shows the vein 5½ feet wide, consisting of leached-out gangue rock, with the exception of an 8-inch streak of quartz carrying pyrite. A sample across 5½ feet returned: Gold, trace; silver, trace; tungstic oxide, 0.4 per cent.

An open-cut at the peak of the ridge, 30 feet north of the last one, shows 2½ feet of a vein consisting of rusty quartz, sericite, hornblende, limonite, and decomposed granitic rock. Some calcite was noted here and quartz crystals are developed in vugs in the vein. A sample only showed a trace of tungstic oxide.

The only opening on the vein which shows an appreciable wolframite content is the main cut on the ridge. Here pieces of wolframite as big as a walnut have been taken out and small crystals are disseminated through the crumbly, oxidized vein-filling. This vein was rather extensively sampled, as it was thought that wolframite might occur throughout the gangue in such small particles as to be indistinguishable to the eye. The results of sampling do not show this to be the case. At the time of examination a series of samples were taken by another engineer, and the results of these were even less encouraging than the results enumerated above.

This vein is strong and well defined and as a vein looks promising. It is possible that further development might show up shoots of wolframite ore which would pay to work. At the present time the demand for tungsten ore is not as great as it was during the war, but it is probable that the market will revive again.

Le Roi Group.

This group of four claims is owned by Leverett Bros. It is situated on the south-east side of Rocher Déboulé mountain at the head of Seven-mile gulch. The elevation of the cabin is 3,945 feet and the showings are up about 400 feet higher. A trail which leaves the *Daly West* road and runs to the cabin is good enough for horses except the last half-mile. The formation here is granodiorite, the location of the claims being well within the granodiorite core of Rocher Déboulé mountain. The first showing is at an elevation of 4,250 feet, consisting of a tunnel driven in 34 feet on an acid dyke which has been considerably decomposed and kaolinized. There is no evidence of valuable minerals in this material. At some distance above the tunnel there is a small vein 10 inches in width striking up and down the hill. This carries a little arsenical iron, which, however, on assay showed only traces of gold and silver.

Near the top of a hog-back and at an elevation of 4,950 feet is a vein striking north-west and lying flat. On the footwall is a 10-inch band of quartz and hornblende carrying some

arsenical iron. Next to this is 1½ feet of granitic vein-filling with hornblende, making a total width of the vein of 28 inches. A sample of the 10-inch quartzose band assayed: Gold, 0.24 oz.; silver, 0.3 oz.

The present showings on this property are not of importance, but further prospecting might show up some more promising parts of the veins.

Blue Bird Group.

This group consists of the *Blue Bird*, *Elizabeth*, and *Bromide* claims and is owned by Geo. B. Tallman. It is situated five miles from New Hazelton in a southerly direction in the basin at the head of Mission creek. A wagon-road extends from New Hazelton to the *Daly West*, a distance of a mile, and from this road a trail branches off to the *Blue Bird* group. The formation here is entirely granodiorite of a very massive texture. A tunnel has been driven 36 feet, which crosscuts a wide dyke of felsitic rock and then continues on into granodiorite. The dyke strikes north-east and small fractures cut it at 45 degrees north and south.

Slight mineralization with chalcopyrite and pyrite occurs in these fractures. The fractures are so small and discontinuous and the mineralization so slight that the occurrence is of no importance and of no commercial value. The whole dump from the tunnel would not run more than a trace in copper. Further work on this showing would be inadvisable, but on account of the location of the property careful prospecting of the ground for definite veins might be worth while.

Silver Standard Mine.

The *Silver Standard* mine, owned by the Silver Standard Mining Company and situated on the north-western side of Glen mountain, six miles by road north of New Hazelton, had a satisfactory year in 1918, although for a number of reasons the output was curtailed, and at the end of the year the mine was temporarily closed down. Production for the year was 3,500 tons, containing 142 oz. gold, 62,121 oz. silver, 110,868 lb. lead, and 297,372 lb. zinc.

This mine has been described in the Annual Reports for the last six years, in which all details of the early development of the property, geological features, etc., can be obtained.

To summarize briefly: The property was obtained from the original locators, Long & McBain, by the present company in 1910, which carried on steady development until the fall of 1914, when the mine was closed down. Shipments over the railroad were commenced in 1913. In the summer of 1915 the mine was reopened with W. G. Norrie-Lowenthal as superintendent, and satisfactory progress has been obtained since that time. The mine was originally opened by an incline shaft which was put down 450 feet, with drifts at different levels; these workings total about 3,500 feet. A crosscut tunnel was driven at an elevation of 1,581 feet, which strikes the main hanging-wall and foot-wall veins at the 250-foot level of the shaft and connects with the shaft-workings.

The No. 4 vein that was cut by this tunnel has proved to be a valuable one, carrying shoots of high-grade shipping-ore as well as milling-ore. It has been developed by drifting from the tunnel-level and stopes have been started on it.

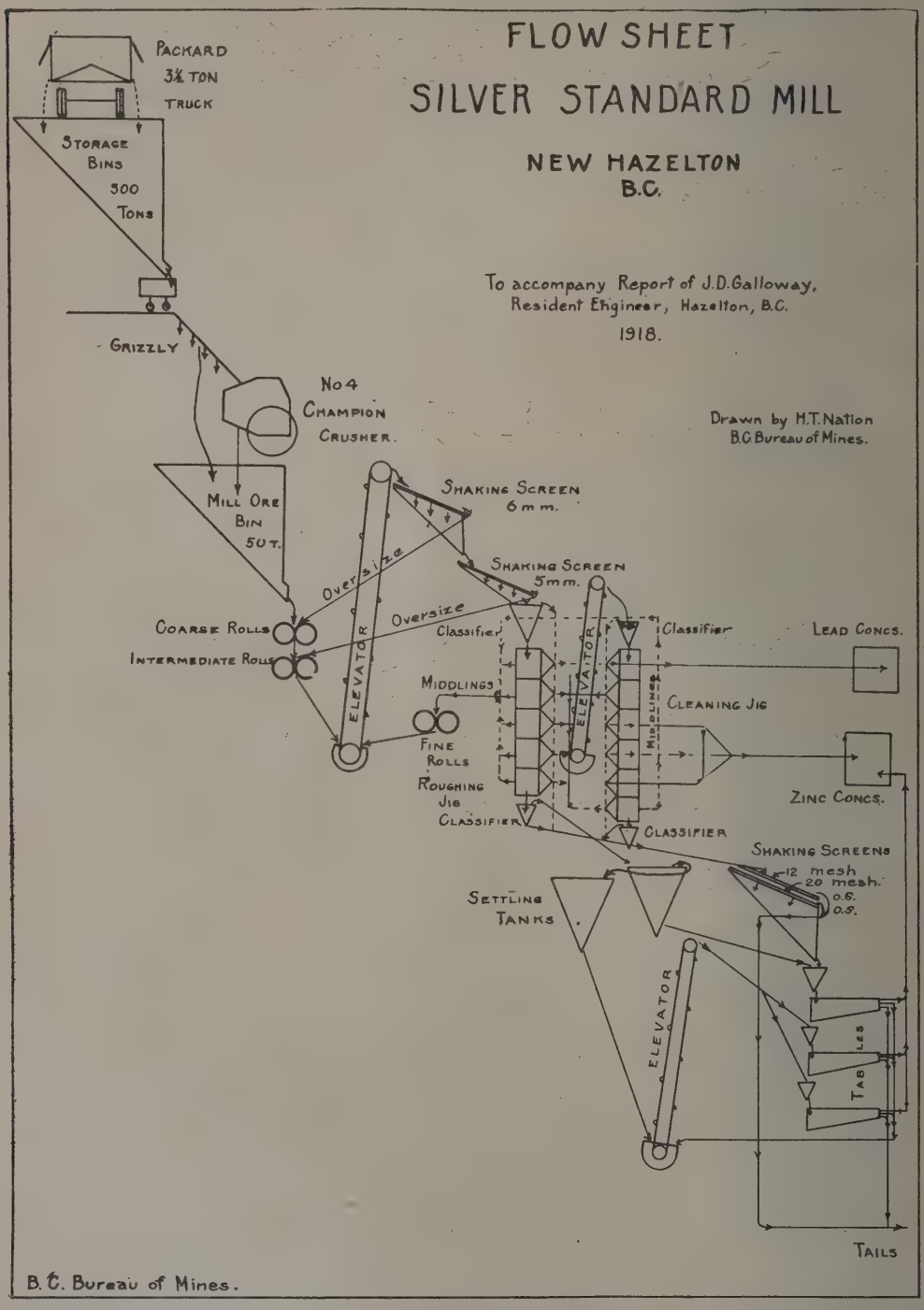
The old steam plant at the shaft has been dismantled, and now the tunnel is the shipping-point for the mine. At this point a power plant consisting of a 60-horse-power distillate-engine and a 5-drill compressor has been erected; the old boiler and compressor from the shaft have also been set up here and can be utilized when necessary.

There are in all nine veins on the property, roughly parallel and striking N. 25° E. (mag.) and dipping steeply to the south-east. The main vein splits into two fissures about the centre of the property, with an angle of about 10 degrees between the strikes of the hanging-wall and foot-wall veins, as the separated portions of the veins are called. The shaft was sunk on the foot-wall vein about 200 feet north of the intersection, and the shaft-workings have developed this and also the hanging-wall vein and the intersection of the two.

Nearly all the veins have been prospected more or less on the surface, but the principal underground workings are on the main fissure and its splits, and the No. 4 vein on the crosscut-tunnel level. Several of these veins will undoubtedly in the future be developed, as the indications are encouraging.

Near the end of 1917 the erection of a 50-ton concentrator was commenced, and this was completed in May. After the delays incidental to getting a new plant in operation the mill worked well and has proved satisfactory. While the mill was being built very little mining was done;

while a part of the time a small force was being kept on development. After the mill started a considerable accumulation of ore in bins and on the dumps was put through, so that very little mining of ore was necessary to keep the mill supplied.



The mill has so far only been run one shift, but in eight hours treats from 17 to 20 tons. It was built by the Faust Concentration Company, of Vancouver. In principle the mill is an

ordinary water-concentrator for the treatment of silver-lead-zinc ores, but most of the machinery is of special design. The jigs and tables are made by the Faust Company and differ somewhat from ordinary types, and a higher extraction is claimed for them. The milling machinery consists of a jaw-crusher, three sets of rolls, elevators, two sets of Faust jigs, three Faust tables, classifiers, screens, settling-tanks, etc.

The mill-site is on Two-mile creek, two miles from the mine. Mill-water is secured from the creek, and also sufficient power to run the tables and the dynamo for the electric plant. Boilers with cordwood for fuel supply the other requisite power. The ore is hauled from the mine-bins to the mill-bins in a 3-ton Packard truck, and from these bins it is trammed into the mill.

The superintendent, W. G. Norrie-Lowenthal, reports that the percentage recoveries in the mill are satisfactory and that the mill is now running nicely. During the year shortage of efficient labour handicapped operations, and in the fall the epidemic of Spanish influenza stopped operations for a time. Development at the mine has been satisfactory during the year, and there are now considerable reserves of milling-ore and also some high-grade shipping-ore. Both the main vein and the No. 4 vein are looking well.

Numerous improvements and additions were made in the way of shops, etc., and comfortable camp buildings have been erected at the mill. A diagrammatic plan showing the flow-sheet of the mill is appended to this report.

Nine-mile Mountain.

During the summer options on a number of the more important claims on this mountain, including the *Sunrise*, *Silver Cup*, *Lead King*, Miller property, and others, were secured by Byron R. Jones, acting for an Eastern syndicate. Work was commenced on the *Sunrise* property and carried on for a couple of months with a small force of men under H. Sparks. This work consisted of surface-stripping and shallow cuts exposing the veins. One vein on the *Sunrise* was exposed 500 feet, maintaining good values and size throughout. Work was stopped in October for the winter, but will be resumed in the spring, when it is expected diamond-drilling will be carried out.

There are a number of veins on these claims, varying from a few inches up to several feet in width and mineralized with galena, zinc-blende, grey-copper, stibnite, and jamesonite. The galena is, as a rule, high in silver content, while the stibnite and zinc-blende also carry some silver. The grey-copper occurs sparingly, but carries a high silver content.

The properties on this mountain were described in the 1914 Annual Report.

American Boy. This property was not worked during the year. In January and February 250 tons of ore was hauled from the dumps to the *Silver Standard* mill and later was treated at the plant. It is expected that development on the property will be proceeded with in the summer of 1919.

Telkwa Section.

There was not a great deal of activity in metal-mining in this district during 1918. The chief disappointment was the failure of the *Santa Maria* to continue to operate on a productive basis. The lease and bond held on this property by the Jefferson-Dockrill Syndicate may expire before long and the property revert to the original owners. Further prospecting of some of the surface showings would seem to be warranted, and it is to be hoped that next year the owners will do this.

The most important development in the district during the year was the opening-up of a small coal-mine by the Telkwa Collieries, Limited. This is the beginning of productive coal-mining in the district, and although the output as yet is small, it is a hopeful sign for the future.

Hudson Bay Mountain.

There are a number of claims on Hudson Bay mountain which have been prospected to a certain extent for some years back. On the north-eastern slope of the mountain are the Schufer, Martin, Carroll, and Hanson properties; on the southern slope are situated the *Coronado*, *Victory*, *Mamie*, *White Swan*, and several other claims. With the exception of the Hanson property, all these have been described in the Annual Reports for 1914, 1916, and 1917.

In 1914 a sleigh-road was built from Smithers to the *Coronado* group, and short trail up the Hill connects the *Victory* group with this road. A few car-loads of ore were taken out from

these properties in former years, but in 1918 the road was in bad shape. A substantial grant was therefore made from the Mines Development Fund and the road so repaired that it is now a good sleigh-road.

The properties on the north-eastern slope of the mountain are reached by a trail running from the wagon-road near Lake Kathlyn Station, the distance to the Schufer property being about six miles, or ten miles from Smithers. A grant was made during the year to repair the lower end of this trail, but, as it was impossible to secure men to do the work, no repairs were effected. This trail will be attended to as soon as the snow goes off in the spring.

Victory. During 1918 further work was done by the owner, Donald Simpson, working alone on the *Victory* group, and a shipment of a carload of ore was made about the end of the year. This property warrants more extensive development than has yet been done.

Schufer Property. During the summer and fall Shufer & Woods worked steadily on their property. In 1917 a short tunnel had been driven on the upper vein, exposing a shoot of galena-zinc-blende ore which carried good silver values. Last season this tunnel was continued and ore was taken out from the vein, partly from the tunnel and partly from open-cuts on the vein above the tunnel. Thirty to forty tons of ore was taken out, and from this 30 tons was packed down to Lake Kathlyn Station, on the Grand Trunk Pacific Railway. This ore was shipped to New Hazelton about the end of the year for treatment at the *Silver Standard* mill.

This vein varies from a few inches up to 2 feet in width and carries in places a band of solid sulphides of zinc and lead. Most of the ore taken out does not require concentration, but does require a separation of the galena from the zinc-blende, as they occur in about equal amounts. The ore shipped to the mill should run about 100 oz. in silver, 15 to 20 per cent. zinc, and 20 to 25 per cent. lead.

Above the tunnel this vein crosses a limestone-band, and on the surface at the intersection the vein widens with a development of low-grade zinc-pyrrhotite ore. Such an intersection might at some part of it reveal a good shoot of the high-grade ore. Further development will be carried out during the coming summer.

Last Chance. This claim is situated on the north-western slope of Hudson Bay mountain, not far from the Schufer property. The owners are O. Hanson and J. Sealey, but last summer the property was under lease to C. G. Anderson, of Prince Rupert. The showings consist of irregular fractures in the volcanic rock which carry a little chalcopyrite, copper carbonates, pyrite, and magnetite. The fractures are irregular and discontinuous, but in places are sufficiently bunched to give rise to a mineralized zone several feet in width.

The main occurrence is in an open-cut 30 x 6 x 4 feet. All the rock taken out from this cut is mineralized but very slightly; possibly it would average 1 to 2 per cent. copper. The east end of the cut is more heavily mineralized than elsewhere, and the average of two grab samples show that a width of 2 to 4 feet would run about 5 per cent. copper.

A short distance to the north of this open-cut a small showing of ore crops on the surface. A crosscut tunnel was started 15 feet below this and had been driven 30 feet without encountering any ore. It is reported that some low-grade was crosscut later on in the fall when the tunnel was driven further ahead.

Patriotic Group. This property is situated on the bank of the Bulkley river, eleven miles below Smithers and three miles from Evelyn Station, on the Grand Trunk Pacific Railway. George H. Ballard is the owner. The rock formation exposed on this property is a schistose rock, originally of an andesitic type. Intruding this is a wide fine-grained dyke which may be classified as a quartz porphyry. The ore-showings are developed in an irregular fracture-zone in the schist about 50 feet distant from the dyke and roughly paralleling the dyke.

The vein strikes S. 80° E. (mag.) and outcrops at the edge of the Bulkley river, passing in a short distance under the bed of the river, while at high water in the spring the showings are nearly covered with water. The vein is a difficult one to prospect, as, owing to the overburden in one direction along the strike of the vein and the river in the other direction, surface development cannot be carried on. The only way to prospect would be by sinking, and this is difficult on account of the water.

The mineral-showings consist of irregular replacements in small fissures in the schist, which, in general, give an appearance of a vein varying from 1 to 4 feet in width. At the time of examining the property the workings were in such condition that very little could be seen and no showings of ore of any size were noted. The predominant ore-mineral present here is zinc-blende, accompanied by galena, jamesonite, and a little pyrite and grey-copper, the galena and grey-copper carrying good silver values. The gangue consists mainly of schist, together with some quartz and calcite.

The workings consist of a shaft 32 feet deep, which owing to water in it could not be examined, a 50-foot tunnel, and an open-cut. In order to keep away from the river the shaft was started in the hanging-wall, and is sunk on an incline dipping away from the river. The shaft was not sunk in ore and a crosscut back towards the river would be necessary to reach the vein.

The tunnel is in a partially caved condition and it is apparent that it did not crosscut any ore. The open-cut is the only place where ore was seen, and here it was considerably oxidized. A sample taken across 2 feet in the bottom of the cut assayed: Gold, trace; silver, 22.2 oz.; lead, 2 per cent.; zinc, 34.8 per cent. A selected sample of ore returned: Gold, 0.02 oz.; silver, 124.8 oz.; lead, 46 per cent.; zinc, 20.4 per cent.

Babine Range.

Harvey Group. This property, which consists of five claims held by annual assessment, is owned by C. G. Harvey and partner. It is situated on the eastern slope of Driftwood creek at an elevation of about 4,000 feet and distant twelve miles from Smithers, the last four miles of which is by trail. Mr. Harvey has worked the property in a small way during the last three years and has made some shipments of high-grade hand-sorted ore; about 25 tons in all has been shipped.

There are two well-defined veins on the property and several other mineralizations which represent mineral depositions in sheeted zones. The rock formation may be classified as andesite, generally of a purple colour; in places it is fine-grained, while in others quite porphyritic. This rock is the normal andesite of the Hazelton formation. The gangue material of the veins is largely andesite somewhat altered, together with stringers and bunches of quartz. The veins, which are of the replacement-fissure type, carry chalcocite, grey-copper, bornite, chalcopyrite, covellite, and, from oxidation of the sulphides, some carbonates of copper. The most important metal content in the ore is silver, which is apparently carried in the grey-copper. Some assays, however, show high copper values and low silver; this would seem to indicate that the chalcocite carries but little silver.

The lower vein is developed by a shaft 18 feet deep. At the bottom the fissure is broken over a little, but is coming in again in the hanging-wall. The vein averages about 4 feet in width and carries copper minerals disseminated through it in an irregular manner. A sample taken across 3½ feet at the bottom of the shaft assayed: Silver, 34 oz.; copper, 1.85 per cent. The sorted ore will run much higher; the gross value of all ore shipped was about $200 a ton.

The upper vein, which parallels the lower one about 75 feet distant in a horizontal line, is developed by a shaft 65 feet deep; the vein dips steeply at the mouth of the shaft, but gradually flattens out and is apparently broken over. At the time of the examination there was 15 to 20 feet of water in the shaft, but there is said to be a streak of good shipping-ore 18 inches in width in the bottom.

At a point 25 feet down the shaft a drift has been run on the vein for 20 feet and a short winze put down. From here an irregular stope has been worked upwards, and from this most of the ore shipped was taken. In this working a streak of nearly solid copper sulphide of 3 to 4 inches in width can be seen, and lower-grade disseminated ore occurs throughout the vein, which varies from 1 to 4 feet in width.

Victoria Group. This group, consisting of the *Lead Creek*, *Victoria*, *Prospector's Dream*, *Morning Star*, *Lakeview*, and *Spokane* claims, is situated in the Babine range just east of the divide on the Babine lake slope. The property is distant from Smithers about twenty-five miles. The wagon-road from Smithers to S. Johnston's ranch on Driftwood creek is followed; then a trail for the balance of the distance. Two miles above

Johnston's ranch the main trail up Driftwood creek is left, and a branch trail is followed over the summit and along the eastern slope of the Babine range to the property. The owner is Patrick J. Higgins, of Spokane, Wash. Each summer for several years back Mr. Higgins has worked the property, doing more than was necessary for annual assessment on the claims.

This group lies about three miles in a direct line from Cronin's mine, and is so situated that a road two or three miles in length would connect it with the sleigh-road to that property at a point about twenty-five miles distant from Telkwa.

The rock formations exposed on this property are almost identical with those occurring at the Cronin mine. Geologically the formations and occurrences of mineralization are the same.

Black argillitic schists and slates are the predominating rocks, but they are intruded by a light-coloured acid igneous rock which may be classified as a rhyolite, although in places it may approach in texture a granite porphyry. The ore-bodies occur at and near the contacts of the schist and rhyolite. More or less definite veins occur, but these will probably be found to follow in a general way the contacts.

The mineralization is the lead-zinc type, the important minerals present being galena and sphalerite. Grains of pyrite quite frequently occur in the ore and associated schist. Grey-copper probably occurs in sparing quantities with the galena and zinc-blende. The silver values are quite good; assays show from 1 to 2 oz. of silver to the unit of lead.

The gangue material consists of quartz and some calcite and siderite; radiating veinlets of quartz in schist often make up the vein. Two or three different veins are recognized by Mr. Higgins, and on each of these some work has been done. These veins or ore-bodies are somewhat oxidized on the surface and are to some extent broken up and irregular; probably there is some faulting, which, however, owing to the conditions of the surface is not easily recognized.

The main vein, which strikes S. 10° E. and dips 70 degrees to the east, lies close to a contact between schist and rhyolite, but is in most places in the schist. It has been developed by surface cuts, a 50-foot shaft, and a tunnel 140 feet in length. The shaft could not be examined owing to water; it is not sunk on the vein, but in schist. From the bottom a 6-foot crosscut was run, but did not strike the vein, and it would seem as if another 15 feet would be required to reach it.

The tunnel is run on a crosscut for 120 feet to where the vein was struck. At the time of examining the property the ore had been drifted on for 15 feet and work was continued for a short time after. At the face of the tunnel there was 2 or 3 feet of mixed ore, galena, and zinc-blende in a quartz and schist gangue; this ore would make good mill-feed. A sample of the clean galena assayed: Gold, 0.06 oz.; silver, 86.2 oz.; lead, 55 per cent.; and a sample of clean zinc-blende returned: Gold, 0.02 oz.; silver, 22 oz.; zinc, 52.8 per cent.

Mr. Higgins reports that he drove this tunnel some 30 feet farther and that the vein is now 4½ feet between walls and well mineralized, an average sample across the vein returning 17 oz. silver and 14 per cent. lead.

A large surface cut has been made on this vein, and from this place a shipment of ore was made a few years ago. This cut is somewhat caved in and had snow in it when examined, so that not much information could be obtained. A sample across 2 feet at one end of the cut gave the high assay of: Gold, 0.5 oz.; silver, 298 oz.; lead, 21 per cent. This high silver content may have been due to the presence of considerable grey-copper.

The No. 2 vein is developed by a 40-foot shaft, from which 5 tons of ore was shipped, assaying 51 oz. silver, 25 per cent. lead, and 38 per cent. zinc. This vein is about 18 inches wide, very much brecciated, and lies in the schist.

The No. 3 vein is developed by a tunnel 15 feet long, which shows a vein lying between rhyolite and schist and striking S. 25° E. (mag.). The vein consists of from 2 to 4 feet of quartz and is only sparingly mineralized.

The ore-showings on this property are worth further development, as the grade of the ore is good and the geological nature of the ore-bodies is such that considerable shoots of ore may be discovered.

This group is situated on the east side of Cabin creek, one mile below the Higgins property, which is at the head of the creek, and about three miles from the Cronin road. An attempt was made to find the showings on this property, but the most important ones were not found. The mountain rises steeply from the creek, with bluffs above and rock-slide below.

Coal-outcrop, Telkwa River.

Coal-outcrop, Goat Creek.

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Simpson Property.

Some small cuts have been made to prospect showings in a bluff 1,000 feet above the creek. These consist of fractures in a rhyolite rock which are slightly stained with copper carbonates. The rhyolite is apparently a wide irregular dyke which has been very slightly fractured along certain zones. Occasional specks of copper-glance can be seen, but copper-stain is scattered throughout a width of 30 to 40 feet. Average samples of the copper-stained rock would not assay more than ½ of 1 per cent. copper.

It was learned later that at the head of a small basin at some distance from these showings there are more promising occurrences of copper minerals.

Social Group.

This group consists of four claims—the *Iroquois*, *Carl Marx*, *Parker Williams*, and *Annex*—and is owned by A. P. McCabe and P. McPhee. It is situated on the south-easterly side of the mountain at the head of the East fork of Driftwood creek and about twenty miles from Smithers. The elevation of the showings is about 5,800 feet. The property is reached by the trail which leaves Driftwood creek above Johnston's ranch. This is the trail that goes to the Higgins property, but the *Social* group is a few miles closer to Smithers.

The main showing consists of a well-defined vein occurring in andesite. The foot-wall rock is more porphyritic than the hanging-wall, but both are andesitic in type. The vein is a replacement fissure in this andesite.

The ore minerals present are copper-glance, grey-copper, malachite, and azurite. The sulphides have been very considerably oxidized, with the result that copper carbonates and iron oxide are very freely distributed throughout the vein and exceed in amount the sulphides present. This is probably a surface condition which would change at depth.

The main working is a tunnel 73 feet in length, besides which there are several surface cuts and pits. The tunnel shows the vein to vary in width from a few inches up to 4 feet. Thirty feet in the tunnel the vein is from 3 to 4 feet wide, continuing for a short distance and carrying some nice-looking ore. Then the vein pinches down, but commences to widen again near the face of the tunnel. At the face the vein is 2 feet wide, but only 1 foot on the hanging-wall side is mineralized. A sample taken across this foot of ore assayed: Gold, trace; silver, 1.5 oz.; copper, 6.2 per cent. A sample taken across 4 feet at a point 30 feet in the tunnel returned: Gold, trace; silver, 4 oz.; copper, 13 per cent.

In an open-cut 25 feet above the tunnel there is a nice showing of ore, the liberal distribution of green and blue carbonates making it look quite showy. On the foot-wall there is one streak of copper-glance a few inches wide. A sample taken across 4 feet, the full width of the vein, assayed: Gold, trace; silver, 2.8 oz.; copper, 12.9 per cent. Selected high-grade ore will run about 25 per cent. copper. This vein can be traced up and down the hill for a short distance and can be developed further by a drift-tunnel.

On the *Carl Marx* claim facing into the South fork of Driftwood creek there are a number of irregular stringers and impregnations of copper minerals scattered through the rock.

The country-rock consists of various phases of andesite, in some places porphyritic, and in others brecciated. Narrow bands of limestone and serpentine interbedded with the andesite were noted in places. The ore follows the limestone-band.

Some of the showings were covered with snow and could not be examined. Very little work has been done here yet, and more will have to be done before a proper idea of the ore occurrence can be obtained. The indications are such as to warrant surface prospecting to see if appreciable ore-shoots occur.

A sample typical of the ore in this place gave a return of 4 per cent. copper. In one place there is a width of 10 feet of rock and mineralized stringers which should average up to this sample.

Cronin Mine.

This property was worked for a short time during the summer, but in the fall operations were stopped for the winter. The property was examined by several engineers during the season, and it is reported that before next spring arrangements will have been made to develop and equip the property so as to put it on a productive basis. A low-level crosscut tunnel has been projected for some time by Mr. Cronin, and this policy of development may be carried out.

During the year some further work was done on the sleigh-road to the property from Telkwa by the Public Works Department. No ore was shipped during the year.

Dome Mountain Camp.

Dome mountain forms part of the Babine range, but stands out distinctly from the main mass of the range, with lower elevations all around it. It is dome-shaped and nearly flat-topped, rising to an elevation of about 5,300 feet; timber-line is at about 4,700 feet.

The route to the camp is from Telkwa, the first fourteen miles being on a wagon-road and then twelve miles of trail which is in fair condition. This distance could be shortened a few miles by a direct road, as the mountain is about twenty miles distance in a straight line easterly from Telkwa.

Geological Features.—The whole mountain consists essentially of schists of various kinds. The rocks in their original condition were probably mainly of volcanic origin with some interbedded sediments, but by metamorphism they have all been rendered more or less schistose.

The showings of ore are found in well-defined quartz-filled fissures, which vary in width from a few inches up to several feet. There are quite a number of veins all roughly parallel with a north-westerly strike. The metallic minerals occurring in the quartz gangue are arsenopyrite, pyrite, a little chalcopyrite, and small quantities of galena. The main value is in gold, but in some instances the silver content runs up, and in one instance the copper value is the most important. It is evident from numerous assays that the arsenopyrite and pyrite, as a rule, carry good gold values, but that the quartz gangue rarely carries much value. The silver is associated with the galena, but the amount of this mineral in the veins is relatively unimportant. The possibilities of the camp, however, must be considered from the gold values present.

Silver Fox. This claim is situated on the north-east slope of Dome mountain and is owned by Geo. Hazelton, Joe Bourgon, and T. J. Thorp. The vein, which occurs in schist, is from 12 to 18 inches wide. It is developed by a shaft 10 feet deep (full of water at time of examination), open-cuts, and stripping. The minerals noted in the quartz gangue were arsenopyrite, pyrite, zinc-blende, and galena. This vein has the prevailing north-westerly strike and dip to the south-west of about 45 degrees. A sample of selected sulphide ore assayed: Gold, 1.3 oz.; silver, 10 oz.; lead, 8.1 per cent. A sample taken from a cut where the vein widened out to 3 feet, but carried no sulphides, only returned a trace of gold and 1 oz. silver to the ton.

The upper vein on this claim varies from 2 to 5 feet in width, and is exposed in open-cuts for a length of 50 feet. It consists of massive quartz carrying a very little pyrite, the whole being somewhat rusty in appearance. It is a well-defined vein, but from the small amount of sulphides present will probably be low grade. It is supposed that this vein is a continuation of one of the *Gold Seal* veins. The strike is the prevailing one and the rock it occurs in is a schistose andesite. A sample taken across 4 feet, which is probably a representative sample of the vein, assayed: Gold, 0.12 oz.; silver, 1 oz.

La Petite. This claim adjoins the *Silver Fox* and is owned by T. J. Thorp. The vein is supposed to be, and probably is, a continuation of the *Silver Fox* vein, the distance between the showings being about 1,200 feet. This vein, which is from 10 to 12 inches wide, occurs in a dark-coloured basic rock which is not as schistose as most of the rock formations on the mountain. The dip is about 70 degrees to the south-west. The vein is considerably oxidized and leached on the surface. Development consists of some open-cuts. A sample across 10 inches of ore assayed: Gold, 8 oz.; silver, 8 oz.

Lying to the west of this vein there is another one which may be a continuation of the *Gold King* vein; it is a well-defined fissure 1 foot in width. The quartz gangue contains cube pyrite and traces of chalcopyrite and arsenopyrite. The strike and dip is the usual one and the enclosing rock formation is schist. Development consists of surface cuts. A grab sample from one of the dumps which is representative of the vein-filling assayed: Gold, 1 oz.; silver, 2 oz.

Gold Seal Group. This group of four claims is situated on the northern end of Dome mountain, with the showings just above timber-line. The owners are T. Heslip and R. Robertson. There are four veins on the property, approximately parallel and contained in a width of 400 feet. No. 1 vein is the most easterly and has the usual north-westerly strike and dip of about 55 degrees to the south-west. It occurs in schist and carries arsenical iron and a little galena in a quartz gangue. A cut 15 feet long with a 10-foot face shows the vein to be 9 inches to 1 foot in width and well mineralized. A sample across 9 inches gave returns of: Gold, 4.28 oz.; silver, 2.8 oz.

No. 2 vein is exposed on the *Blue Grouse* claim and is exposed by a 10-foot open-cut with a 5-foot face. This vein is irregular and is broken up into bands with bunches of schist between. The quartz is slightly mineralized with cube pyrite and arsenical iron. A sample taken across two bands of 4 feet assayed: Gold, 0.32 oz.; silver, 1 oz.

The No. 3 vein shows on the *Blue Grouse* claim. A shaft 8 feet deep shows the vein to vary between 1 and 2 feet in width, consisting of bands of quartz and schist. The quartz gangue is slightly mineralized with iron sulphides. A sample across 2 feet at the bottom of the shaft on assay only showed traces of gold and silver.

No. 4 vein is exposed on the *Gold King* claim. An open cut 25 feet long shows a vein 3 to 4 feet in width, consisting of mixed bands of quartz and schist. This vein, unlike the others, dips 45 degrees to the north-east; but it has a parallel strike. A rough grab sample representative of the vein returned on assay only traces of gold and silver.

Four hundred feet along the strike and up the hill this vein shows as two stringers 20 feet apart and a stringer dipping at 45 degrees between them. This central band of quartz or stringer is probably the main fissure, with the others subsidiary ones. A shaft has been put down on this 10 feet and on the east stringer another one 15 feet deep.

The width of quartz in these bands is variable, in places only a few inches and in others up to 3 feet. There is some nice ore exposed in these workings. The quartz carries galena, pyrite, and arsenical iron. From the shafts about 5 tons of the most heavily mineralized quartz has been sorted out and piled on one dump. An average sample of this assayed: Gold, 1.52 oz.; silver, 3.6 oz.

A short distance above the shafts a small cut shows a clean-cut vein 1 foot wide and well mineralized. The strike at this point is N. 70° W. (mag.) and the dip is 75 degrees to the south-west. A representative sample of the vein assayed: Gold, 2.90 oz.; silver, 3.6 oz.; copper, 0.5 per cent. A test for nickel was also made on this sample, but it was not found to contain any.

Higgins Property. There are two claims in this group held by Higgins & Dobie. The showing is practically on the highest point of Dome mountain, which, however, is nearly flat. A tunnel 30 feet long shows a small vein 6 inches to 1 foot wide lying in schist. The quartz is mineralized with chalcopyrite, arsenopyrite, and pyrite. Above the tunnel the vein has been taken out to a slight depth in a long narrow open-cut. From the rock taken out in these workings about 15 tons of ore had been selected by hand-sorting, but this was never shipped and is still lying on the dump. An average sample of this assayed: Gold, 0.94 oz.; silver, 3 oz.; copper, 3.9 per cent. It is evident that this grade of ore would not pay to pack out, and as the vein is small the proposition was not very promising.

Gold Standard. This claim and the *Lucky Boy* are owned by Hazelton, Bourgon & Thorp. The vein, which is exposed on a little creek 400 yards east of Hazelton's cabin, is a well-defined quartz-filled fissure striking N. 40° E. and dipping at 45 degrees to the south-east, and occurring in schist. The vein crosses the creek and is well exposed on either side and in the creek; on each side large open-cuts have been made, showing a width of 3 to 4 feet of quartz.

Pyrite and arsenopyrite are the only metallic minerals in the quartz, and these form but a small percentage of the vein-filling. A representative sample of the dump from one of the cuts assayed: Gold, 0.12 oz.; silver, 4 oz. Another sample taken across 3 feet 6 inches on the east side of the creek returned: Gold, 0.26 oz.; silver, 2 oz.; while a selected specimen of sulphide gave: Gold, 0.82 oz.; silver, 4 oz.

Hoops Group. This group of two claims is situated on the south-east end of the mountain and near the top. There is here a quartz vein from 2 to 4 feet wide lying very flat and striking N. 40° E. The formation in which it occurs is green schistose andesite. The development consists of a number of open-cuts and stripping, spaced over a distance of about 300 feet, which apparently show two or three different veins, but these may be portions of the one vein separated by faulting.

This vein is quite similar to the others on the mountain, consisting of a quartz gangue carrying iron sulphides and in places a little chalcopyrite. The flat dip of the vein and its broken-up appearance show that it has been somewhat faulted.

A sample across 3 feet in the highest cut assayed: Gold, 0.34 oz.; silver, 4 oz.; another taken from a small dump assayed: Gold, 0.28 oz.; silver, 4 oz. Selected pieces of ore showing some chalcopyrite returned on assay: Gold, 0.20 oz.; silver, 14.6 oz.; copper, 2 per cent.

The most southerly open-cut shows a nice-looking vein about 3 feet in width, well mineralized with pyrite and a little chalcopyrite.

Paradise Group.

This group consists of the two claims known as the *Ruth* and *Paradise*, owned by Steve Young. It is situated in the Mosquito Pass district, fourteen miles from Telkwa and on the route to Dome mountain. The showings are on the side of a small creek, the waters of which flow towards Babine lake. There is here a shear-zone in green andesite which is from 15 to 30 feet wide. In places in this zone there is a width of from 5 to 10 feet of quartz mineralized with pyrite, magnetite, haematite, and a little arsenopyrite and pyrrhotite. No chalcopyrite was noted. The zone strikes east and west and dips to the south at a very flat angle.

From the appearance of the mineralized quartz it might have been expected to have carried some values in gold and silver, but assays of three samples, including one of selected sulphides, only showed traces.

Chisholm.

This claim was owned by Chisholm & Young. A shaft 30 feet deep was sunk on the vein, and from this a shipment of 14 tons of hand-sorted ore was made, which returned about $50 a ton, mainly in gold values. The shaft had water in it so could not be examined, but there is said to be a width of 8 inches of sulphide ore at the bottom.

In a cut 20 feet north of the shaft the vein is exposed and has a width of about 2 feet. It is sparingly mineralized with iron sulphides, but does not look promising. A sample taken here only gave a trace of gold and 2 oz. of silver to the ton. It is apparent that only the sulphides carry values, and they form but a small percentage of the vein.

Maple Leaf and Shamrock.

These claims, which are owned by Hazelton, Bourgon & Thorp, are situated on the east side of Dome mountain, away down in the timber, and about a mile and a half east of the cabin. The showings are on the bank of a little creek and quartz-outcroppings occur in the bed of the creek. Two tunnels have been driven on the south side of the creek, which were commenced in gravel and clay. The most westerly one was driven for 25 feet through the wash, and then strikes the rock and continues for 10 feet farther. The vein was crosscut here, but it is lying very flat as if broken over. Apparently the vein proper is about 4 feet in width, but the walls are impregnated with quartz stringers. The vein is partly quartz and partly schist, the whole being very much leached and rotten. Siderite, pyrite, and a very little galena were noted in the vein. A representative sample only assayed: Gold, 0.02 oz.; silver, 0.05 oz. The dump looks as if it consisted mainly of rock-matter, very considerably decomposed, but a grab sample gave the high assay of 1.62 oz. gold and 4.2 oz. silver to the ton.

Thirty feet to the east the second tunnel has been driven; it is 40 feet long and at the face cuts the vein, which at this point consists of 8 to 10 feet of rock-matter, carrying through it stringers and bunches of quartz. It is really a sheared zone in which some quartz and metallic minerals have been deposited by replacement. No sulphides were noted in the vein material in this place, and the general appearance of the vein was such that it was not considered advisable to sample it.

Telkwa Collieries.

The Telkwa Collieries is a company composed of Prince Rupert and Telkwa men which was formed to acquire and operate a small area of coal land near the mouth of Goat creek, a small stream joining the Telkwa river four miles above Telkwa. A large area of coal land along Goat creek and extending down the Telkwa valley to the Bulkley river is owned by the Cassiar Coal Company. The company has Crown grants for this, including the surface rights, and for some years back has not attempted to do anything with the property.

In 1917 J. Ashman discovered that some sections of land near the confluence of Goat creek with the Telkwa river were vacant, and it is these sections that now form the holdings of the Telkwa Collieries.

The coal-showings on the Telkwa river and Goat creek attracted attention many years ago, before the Grand Trunk Pacific Railway was under construction. These areas were examined and reported on by W. W. Leach, of the Geological Survey, his reports appearing in the Summary Reports for 1906, 1907, and 1908. During these years a number of the coal-showings were tested by surface work and a limited amount of drilling. This early work did not prove very satis-

factory, and before the railway was completed in 1914 all development had been stopped. The exploratory work done on the areas contiguous to Telkwa apparently showed that there were a number of small coal-basins or remnants of a once extensive field, and that the measures in these basins were broken, flexed, and faulted. The quality of the coal in many cases was excellent, but the broken condition of the formations was considered to be a great handicap to successful mining.

Much of the early testing of these coal-basins was done by the Grand Trunk Pacific Railway Company or by others who expected to sell their coal to the railway company. The engineers for the Grand Trunk Pacific finally decided that there was no sufficient available supply of coal, either near Telkwa or elsewhere along the route of the railway in British Columbia, which could be relied upon; and so the railway was equipped with oil-burning locomotives throughout the western division. The best market for coal at Telkwa was therefore shut off.

In the last two or three years, however, the price of fuel-oil has gone up very considerably and the demand for coal has been greater than the supply. The Grand Trunk Pacific is now using coal in its locomotives from Prince George east, and is ready to take coal if it can be supplied from any point on the railway. This has aroused fresh interest in the possibilities of these northern coalfields and further development in the near future is probable.

In the meantime the Telkwa Collieries, although commencing in a small way, is getting along satisfactorily. In the winter of 1917-18 a tunnel was driven on one seam and some test shipments made to Prince Rupert, which proved satisfactory. In the summer and fall of 1918 a branch road half a mile in length was built into the property and repairs were made to the main road up the Telkwa river. Coal-bunkers, camp buildings, etc., were erected, and late in the fall shipments were commenced. By the end of the year the production was at the rate of 30 tons a day, which was expected to be soon increased to 50. The coal is handled by teams to Telkwa (four miles and a half), loaded on the railway-cars, and shipped to Prince Rupert, where it is marketed.

The exposure of coal on which this company is working at present occurs on Mud creek, a small tributary joining Goat creek just a short distance from the Telkwa river. The area of coal formation at this point, as exposed, lies in the V-shaped piece of land lying between Mud and Goat creeks. At this place these creeks run in channels cut down 100 feet or more below the general level of the country. On Mud creek the banks rise steeply and give a section of the coal-measures for some distance going up the creek. At this point some years ago a tunnel was driven in on one seam for 90 feet, when the coal was cut off abruptly by fine sand. This tunnel was driven in the direction of Goat creek, and it is evident that at this point the coal formation had been eroded away and the erosion-channel filled with sand.

The Telkwa Collieries commenced work on a seam 15 feet lower than the other one. Although at a lower horizon, this seam outcrops farther up the creek, as the dip of the seams is to the north, down the creek. On this main seam a tunnel was driven 115 feet which shows 8 feet of nearly clean coal, with the exception of an 8-inch clay-parting. On the upper or 6-foot seam a short tunnel has been driven and connection made to the main seam by a short incline. From the tunnel on the main seam the coal was taken out which was shipped in the spring of 1918. At the time of examining the property (August, 1918) coal-bunkers, etc., were being erected and no work was being done in the mine. Since that time the main tunnel has been driven ahead, rooms commenced, and the property put in shape for steady production.

Goat Creek Seam.

On the property of the Telkwa Collieries there is another nice-looking seam of coal which outcrops in the bed of Goat creek and extends along the creek-bed for about 200 feet. This seam strikes east and west and dips at about 14 degrees to the north. The seam is 8 feet thick, with one main clay-band 8 inches thick. A representative sample of the seam had the following analysis: Moisture, 0.06 per cent.; volatile matter, 33.9 per cent.; fixed carbon, 56 per cent.; ash, 9.5 per cent.

Some attempt was made some years ago to prospect this seam, the work being started away from the creek where the coal outcrops. The work was never carried far enough to prove anything and the openings are now caved in. It would seem from the surface indications that this seam of coal may underlie the country to the north and east for some distance. No boring

has ever been done here, so that this remains a likely field for exploration by diamond-drilling. To the east of the outcrop a short distance is the boundary-line of the Telkwa Collieries land. Beyond this to the Bulkley valley is owned by the Cassiar Coal Company.

SIBOLA SECTION.

The name "Sibola" is used to designate an area of country lying to the south-west of Houston, a station on the Grand Trunk Pacific Railway. This area includes the claims around Owen lake, on Sweeney mountain, and around Whitesail lake. A description of this country can be found in the Annual Report of the Minister of Mines for 1916. Since that time some further prospecting has been done and annual assessment-work has been kept up on many of the claims. No extended development of any kind has been carried out.

The most important property in the district is the *Emerald* group, situated on Sweeney mountain and owned by Sweeney, Benson, and partners. The showing consists of a vein varying from 10 to 20 feet in width and mineralized chiefly with galena, together with subsidiary amounts of zinc-blende, pyrite, and chalcopyrite. The percentage of galena to gangue is high, sufficiently so as to make good milling-ore, and in many places there are bands of clean galena from 1 to 3 feet in width. The showing is a remarkable one, and now the vein has been traced for 1,000 to 1,500 feet in length and showing values everywhere.

This group was staked in 1915 and would not have remained undeveloped but for its distance from a railroad. The transportation problem is admittedly a difficult one for this property and district generally, but it is by no means insurmountable.

In November, 1917, James Cronin secured an option on the *Emerald* group for one year by making a cash payment; in this deal Mr. Cronin was acting for an Eastern American syndicate. This syndicate sent out an engineer in the summer of 1918, who, after examining the property, reported that the location of the property was such as to make it undesirable to take up the option. The Eastern syndicate thus dropped out of the transaction. Mr. Cronin, however, still held his option and renewed it for another year—or until November, 1919—by making a further cash payment. In this last deal Mr. Cronin is backed by Idaho interests. It is expected that the property will be actively developed during the coming summer.

A number of other claims are staked on Sweeney mountain, some of which will warrant development when transportation of some kind has been arranged into the district.

The present route into Sweeney mountain is by an indifferent pack-trail which commences at Houston, on the Grand Trunk Pacific Railway; the distance is about fifty miles. Another very rough trail, known as the Bonthrone trail, runs from Sweeney mountain to the wagon-road passing near the western end of Ootsa lake. This wagon-road is one which extends from Houston around the west end of Francois lake to Ootsa lake, continuing on to the settlement at the centre of Ootsa lake, known by the same name. From here the road extends northerly to Francois lake, where a ferry is operated by the Government, and then on to Burns Lake, a station on the Grand Trunk Pacific Railway. From Ootsa Lake to Burns Lake this road is in good condition, but the other half out to Houston is very rough. It is possible to take a small boat from Ootsa lake up the Tahtsa river to Tahtsa lake, which is only distant a few miles from Sweeney mountain.

For the immediate prospecting and development of this district some better method of getting into it is required than the present trail from Houston. This trail climbs over two summits and is not passable until late in June. Either the old Bonthrone trail should be put in good condition or a new trail constructed starting from the wagon-road at the end of Francois lake.

If a good trail is put into the district considerable development of the properties can be carried out, and after that the question of a transportation system whereby machinery can be taken in and ore hauled out can be considered. A possible route for the ore would be out by a pass through the Coast mountains to salt water on Gardner canal. Another route would be by wagon-road to the end of Francois lake; thence down the lake on boats and a short wagon-haul from the end of the lake to the railway-line.

From Ootsa Lake settlement a small boat can be taken up Ootsa lake, on up Whitesail river to Whitesail lake, and only a short portage of about a mile separates Whitesail from Eutsuk lake. In this way a large area of country can be reached for prospecting by means of water travel from Ootsa lake. Some claims have been staked in the Coast range in this region.

Buff Group. This group is situated on Houston mountain, three miles north-east of Houston, the elevation of the showing being about 3,000 feet. The road is used for two miles and then a trail up the hill for a further distance of two miles. There are eight claims in the group, owned by Pete Slavin, Joe Allen, Fred Heading, and Andrew Martinsen, staked in 1917. At the time of examination (August, 1918) the group was under option to H. L. Roper and two men were at work; the option has since been allowed to lapse.

The showing consists of a vein 2 to 4 feet in width, occurring in a highly siliceous rock which is probably of igneous origin and of rhyolitic type. This vein is not well defined, but has a general strike of N. 25° E. (mag.) and dips to the north-west. It is sparingly mineralized with bornite, chalcocite, and a little grey-copper, and oxidation on the surface has produced plenty of copper-stain. The gangue is quartz and wall-rock.

A few open-cuts have been made and a shaft was started which was down 8 feet. The vein is only slightly mineralized with copper minerals, a band in the centre from 6 to 18 inches wide generally carrying most of the mineral. A few hundred feet to the north along the strike of the vein an open-cut shows a little copper-stain.

Two hundred feet away there is evidence of a parallel vein, but this one is not as well mineralized as the other. Further development might disclose some appreciable shoots of high-grade copper ore on this property, but the present showings are not extensive. An assay of selected ore returned: Gold, trace; silver, 12 oz.; copper, 15 per cent.

CARIBOO MINING DIVISION.

Fort George Section.

No productive mining of any kind is being carried on in this section of the Cariboo Division, but during the season a little prospecting of a few claims was in progress. These places were visited and notes made of what was being done.

Yellowstone Group. This group, situated about fifteen miles north-easterly from Prince George, is owned by Wm. Bonner and Martin Framstad. A wagon-road somewhat rough on the far end goes close by the property. A car can be driven to within about two miles of the claims. The country here is rolling plateau country and no hills of any size occur, the elevation of the claims being about 2,400 feet. A shaft 27 feet deep has been sunk to prospect a quartz vein which strikes N. 50° E. (mag.) and stands vertical. The vein occurs in soft crumbly rock which has more or less of a slaty structure. The vein-filling is quartz and no sulphides in appreciable amounts were noted. Some of the quartz is stained with iron-rust. A sample taken across 4 feet, the full width of quartz, showed only traces of the precious metals.

Snowshoe Group. This group, consisting of *Snowshoe Nos. 1*, *2*, and *3*, is owned by Wm. Bonner, Martin Framstad, J. D. McLennan, and Geo. Hughes. The claims adjoin the *Yellowstone* and are to be grouped together. It is intended that a local company with subscribers in Prince George is to be incorporated to handle these claims. The rock formation here is diorite somewhat altered and silicified. In places there are narrow streaks carrying a little chalcopyrite, pyrrhotite, and pyrite, which are either slight mineralizations along joint-planes or in a sheeted zone. None of these mineral-showings are of any importance or value other than to show the possibility of the occurrence of valuable minerals in this locality. A shaft has been sunk 18 feet so as to include a few of these stringers showing slight mineralization. No appreciable ore was taken out in this work and the dump would not assay more than a trace of copper. It would only be waste of money to carry out further work on these showings, but careful prospecting of the claims might show more promising places to work. A small open-cut shows the contact which occurs between the diorite and slate-schist, but mineralization has not been developed along the contact.

Oregon Group. This group consists of two claims—the *Oregon No. 1* and *Oregon No. 2*—owned by J. E. Bateman. It is situated half a mile east of Giscome Station, on the Grand Trunk Pacific Railway. The showing is in a bluff just above the railway-track and consists of a very slight mineralization in a sheared zone in greenstone. A band of quartz carrying a little pyrite a few inches in width can be seen in places, but it is evident that the occurrence is not important. Assays of the mineralized rock-matter failed to show any values.

HIXON CREEK.

Hixon creek joins the Fraser river thirty-five miles below Quesnel. Some forty years ago a quartz property was worked on this creek by the Quesnel Quartz Gold Mining Company. A stamp-mill was erected and quite a lot of development carried out. Before long the work was stopped and the property has remained idle ever since.

In 1918 Chas. F. Law secured an option on the property, which he turned over to a Boston company. An attempt was made to open up the old workings, which were, of course, completely caved in, A. W. Koch being sent out to take charge of the work. About a dozen men were employed for two or three months, when operations were stopped and the option allowed to lapse.

The property was examined in July shortly after work had been commenced. The important old workings consisted of three shafts and a tunnel. The tunnel was said to be 120 feet in length, with two short drifts off it, and a winze 40 feet deep from one of the drifts. The best showing was supposed to be at the bottom of the winze, consisting of 4 feet of good ore.

The opening-up of this tunnel, which had just been started, was perhaps more difficult than driving a new tunnel. One of the shafts was also being cleaned out and unwatered. A new tunnel was being driven to prospect a 4-foot vein which had not previously been developed, and some surface-stripping was being done.

This new tunnel was driven alongside the quartz vein in schistose rock for 100 feet, the quartz being broken into at successive points. No values were found in the vein, so the work was discontinued. The surface-stripping also failed to disclose anything of importance. The high-grade ore found in the former workings was discovered as the result of placer-workings, and the shafts and tunnel were laid out to develop these showings, which did not crop on the surface.

To find out anything about these veins, therefore, it would be necessary to completely open up the old workings, and it is not believed that the work last summer was successful in doing this. It was found impossible to make any headway against the water in the old shaft, in which an attempt was made to reach the old workings, the flow of water being so great that power-driven pumps would have been required. It is also reported that the work of cleaning out the old tunnel was stopped before reaching the drifts and winze.

The property therefore remains in much the same condition as it has been for many years—viz., what surface showings occur are not promising and the reported high-grade ore in the old workings cannot be examined.

There is still a little ore left on the dump at the ruins of the old stamp-mill. This consists of quartz containing small quantities of pyrite, chalcopyrite, galena, hæmatite, and copper carbonates. Free gold and occasionally native silver in small specks occur in some of the specimens.

Belmont Group.

This group consists of the *Mont Damon*, *Belmont*, and *Virginia* claims and is owned by H. McLarty and S. D. Gillis. It lies a short distance above the Hixon Creek property previously described. A tunnel has been driven in 150 feet, which is mainly in a soft decomposed yellow rock. The tunnel cuts one quartz vein which is from 2 to 4 feet in width, and farther on cuts a 6-inch stringer which was supposed to carry good values; a sample taken, however, only shows 0.2 oz. gold to the ton. The soft yellow rock (schist) was also supposed to carry low values, but a sample from the dump only showed a trace of gold.

Government Creek.

The placer-ground held on Government creek by Dougald Cameron and partners, which was described in last year's Report, was re-examined during the summer. It had been reported that the black sand on this creek carried an appreciable platinum content, and to determine this point some sampling of the ground was done.

Samples were taken from different points in the gravels along two miles of the stream. At one place gravel from bed-rock was put through a rocker and the black-sand concentrate saved. The other samples consisted of the black sand recovered from the panning of two, three, or four pans of gravel.

The black sand from each sample was weighed and assayed for gold and platinum. From these results and knowing the average weight of a pan of the gravel, the value in gold and platinum in a cubic yard of the gravel has been calculated. The following table shows the results:—

Yardage in Sample.	Value in Gold per Yard.	Value in Platinum per Yard.	Total Value per Yard.
12 cubic feet.	$2.94	$0.18	$3.12
1/30	.34	.06	.40
1/30	.10	Trace	.10
1/60	Trace	Trace	Trace
1/20	.52	.01	.53
1/30	.02	.005	.025
1/40	.29	.006	.296
1/30	.05	Trace	.05
1/50	Trace	Trace	Trace
1/20	.79	.03	.82
1/60	.005	Trace	.005

The average of the eleven samples is: Gold, 55 cents a yard; platinum, 3 cents a yard; or a total of 58 cents a yard. From this it will be seen that the platinum values are unimportant, but that the gold content, while variable, averages up well. These concentrates from the panning of the gravels contained most of the gold that occurred in the quantity of gravel panned. Some of it was visible to the eye, but all was fine and probably a portion of it was flour gold.

Quesnel Section.

Tertiary Gravel Company.

In 1917 the old Killam gravel-mine at Cottonwood canyon was acquired by the Tertiary Gravel Company, and the property was equipped with a mill to treat the cemented gravel.* The mill was tested in the fall of 1917, and shortly after work was stopped for the winter. Operations were resumed in the spring of this year and some changes were made in the milling equipment. During the fall the mill worked satisfactorily, treating 50 to 60 tons a day. It is believed that work will be continued all winter. Further development of the gravel-deposit is also to be carried on.

This gold-bearing deposit is a cemented gravel lying on a bed-rock and carrying values throughout a thickness of 10 to 12 feet. Development has been by a tunnel with lateral drifts from it, and the workings total several hundred feet; the gravel-deposit is of considerable size, but the gold values may be variable throughout it.

This deposit of cemented gravel is so hard that it cannot be successfully worked by ordinary placer-mining methods. The system used is to mine the ground as in a lode mine, using compressed-air-driven drills, and then the product is treated in a mill in much the same manner as gold-bearing quartz.

Lightning Creek Gold Gravels and Drainage Company.

The property owned by this company consists of twenty miles of placer leases along lower Lightning creek. The extensive plant and camp buildings of the company are at Wingdam, where there is a post-office; this place is about twenty-eight miles on the Barkerville road from Quesnel and eighteen miles below Stanley.

Along two miles of Lightning creek in the vicinity of the town of Stanley some very rich placer-ground was worked in former years and several millions of dollars taken out. Below Stanley a deep drifting enterprise was started at La Fontaine and the creek-gravels were mined out for some distance. While this mine was successful in working the gravel, it was financially unsuccessful because the gravel carried insufficient gold to pay to mine. Below La Fontaine to Wingdam, Lightning creek has never been worked to any great extent, the ground being too deep to be worked unless by modern methods with adequate pumping machinery, etc.

The surface gravels on lower Lightning creek were probably worked in a small way, but no definite records of this work are available. About twenty years ago the present mining enterprise at Wingdam, which is now the property of the Lightning Creek Gold Gravels and Drainage Company, was commenced. Mr. Unverzagt is treasurer and manager of this company.

* *See* 1917 Annual Report.

Up to the present time the company has been unsuccessful in actually mining the bed-rock gravels of Lightning creek, although much money has been spent in an expensive plant and equipment and three shafts have been sunk. Portions of the channel have been broken into by means of bed-rock drifts from the shafts which were sunk in the rim-rock, but in each case the great pressure of water and gravel encountered when the drift broke into gravel has been more than could be handled. Apparently the problem is to get sufficient pumping equipment to take care of the flow of water, and when this is done it is expected the pressure will be relieved.

During the last five years no actual mining has been done on the property, but work has been carried on each season. In order to test the ground thoroughly a Keystone drill has been in operation each season. In the vicinity of Wingdam several cross-sections of holes have been put down across the valley of Lightning creek. The chief object of this work has been, of course, to discover the values carried by the bed-rock gravels, but in addition it gives valuable information regarding the character of the gravels, slum-beds, depth to bed-rock at different points, and many other features which will assist later in new attempts to mine the gold-bearing gravels.

During the last two years Mr. Brown, an experienced driller, has been in charge of the Keystone drilling, and according to his reports the results are very satisfactory, much of the ground showing sufficient values to pay well to work by drift-mining.

In 1918 the company commenced again to get the surface plant in shape for actual mining, and until late in the fall a crew of about a dozen men was at work under the superintendency of Elmer S. Will. The pumping machinery was overhauled and added to, all other machinery was put in good shape, and the water-power flume was rebuilt, giving more power for running pumps. It is hoped that a start at mining will be made in 1919.

Barkerville Section.

The hydraulic placer mines near Barkerville made a smaller production than in 1917. The water-supply during the year was not very satisfactory, so that a smaller yardage of ground was handled than in the previous year. In the early part of the season the winter's snow melted with great rapidity, causing a flood of water which went to waste, and after that a long dry period occurred, during which there was an insufficiency of water for steady hydraulicking. Not much help was obtained from fall rains, so the season as a whole was unsatisfactory as regards water conditions.

The grade of ground handled is believed to have been about the same as in 1917, and no important new developments were made.

In August Dr. B. R. MacKay, of the Dominion Geological Survey, arrived in the district and spent a few weeks examining the country. Dr. MacKay intends to make a complete study of the placer deposits, and his visit this year was to size up the country and plan out his work for the season of 1919. This work is intended to assist the development of the known deposits and indicate the probable courses of the old drainage systems of the country, with the possibility of indicating likely places where new deposits may be found.

Hopp Mines.—These mines, consisting of *Lowhee*, *Stouts Gulch*, and *Mosquito Creek*, which are operated under the management of John Hopp, were worked as continuously throughout the season as the supply of water permitted. The major portion of the placer-gold production of the Cariboo District comes from these three properties. *Stouts Gulch* mine was worked up to its head in 1917, but this year the work was carried on laterally, side channels and benches being worked. There is still a considerable yardage of gravel to work out, but it may prove to be lower grade than the main channel. *Lowhee* mine was worked continuously throughout the season, and it is reported the average grade of gravel handled was well up to that of former years. *Mosquito Creek* mine was handicapped by shortage of water, and only a small yield of gold was obtained.

Point Mine.—This property, owned by Loo Gee Wing, of Vancouver, was worked during the season under the supervision of Jos. Wendle. Owing to shortage of water the season's output was not large.

Chisholm Creek.—The drifting-work of the Cariboo-Chisholm Creek Mining Company was discontinued early in the year and not started again. The future plans of the company are not known.

Perkins Gulch.—I. I. Felker and W. S. Sparkes for several years past have operated a small-scale hydraulic pit on Perkins gulch, a small creek which comes into Lightning creek about a mile

above Stanley. The deposit being worked is presumably an old channel lying 30 to 40 feet above the present bed of Perkins gulch. During 1918 some rich ground was found and the operations were more successful than in former years. This is a good hydraulic proposition, but is handicapped at present by an insufficient supply of water.

Proserpine Mountain.

Lode-mining in the Cariboo has never as yet proved successful, although for the last forty years intermittent attempts have been made to work various quartz-showings. There are any number of quartz veins in the district, but the majority of them are apparently devoid of gold content. In the early days of these attempts at quartz-mining several stamp-mills were taken in and erected in the district. After short runs all of these suspended operations and in many instances the plants were allowed to go to ruin. The condition of these old quartz properties, which were partially developed, is now such that an examination yields but little information. Examination of the old reports on these various properties shows that in the majority of cases the average value of the ore was quite low, and that, unless worked on a large scale, they could not hope to prove commercially successful. The veins undoubtedly were very pockety, and although some high assays were obtained, on the strength of which much work was done, the average values as disclosed by mill tests were too low to admit of the properties being worked at a profit.

In the early days all costs were probably somewhat higher than they are now, but the chief reason for failure cannot be found in that fact. Undoubtedly many veins were developed which never warranted having any work done on them. Most of the mills put in were 5- or 10-stamp mills, and mining and milling on such a scale required fairly high-grade ore, such as was not shown to occur in quantity in any of the veins that were developed. The result was that quartz-mining in the Cariboo received a succession of "black eyes," which makes it somewhat difficult now to arouse new interest in any gold-quartz showings in the district.

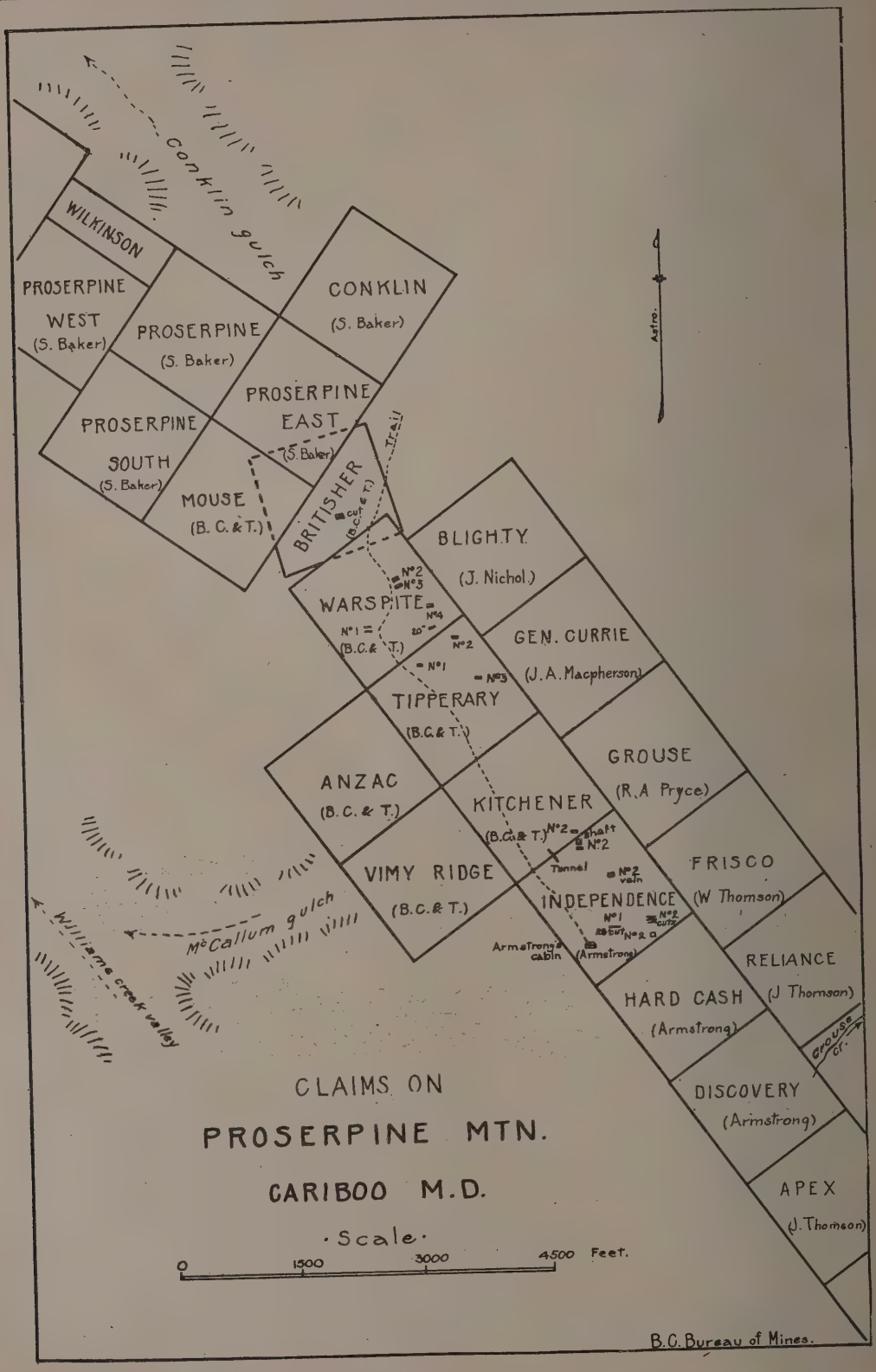
Proserpine mountain is a flat-topped hill lying to the west of Barkerville across Williams creek. Numerous quartz veins crop out on the mountain, some of which were staked and worked many years ago; chief amongst these may be noted the *Proserpine* ledge, which was developed by three shafts. A portion of this ledge is covered by the *Wilkinson* claim, an old 1,500- x 600-foot location Crown-granted and owned by the British Columbia Company. Adjoining this claim are three—the *Proserpine*, *Proserpine South*, and *Proserpine West*—staked by Seymour Baker several years ago and kept up by annual assessment. A description of these claims is given in the 1914 Annual Report of the Minister of Mines.

Proserpine mountain is made up entirely of the formation named by Bowman as the Cariboo schists. This formation everywhere throughout its occurrence in the Cariboo District is characterized by the number of veins, stringers, and bunches of quartz occurring in it. In the opinion of Bowman the source of the placer gold in the stream-gravels of the Cariboo was in this formation. The rocks in this series are mainly slates and schists of varying kinds and some bands of limestone; the whole formation being of sedimentary origin. Dykes cutting this formation are not infrequent, but none were noted on Proserpine mountain. In the bed of Grouse creek, which terminates Proserpine mountain to the east, a porphyry dyke is seen cutting the schists. The Cariboo schists is an old formation and the dykes cutting it are probably also quite old.

The general strike of the Cariboo schists is north-westerly. This formation is as a rule soft and friable, and is eroded easily, except where hard quartzite-bands occur.

The general strike of the quartz veins throughout the Barkerville area is parallel with the strike of the Cariboo schists, but many exceptions occur. The dip of the veins, however, as a rule differs from that of the enclosing schists. Many of the veins stand vertical, while the prevailing dip of the schists is to the north.

A few years ago E. E. Armstrong started prospecting for quartz in the district, and finally located the *Independence* group, which lies considerably to the east of the *Proserpine* group. The two veins discovered by Armstrong on his group did not crop out prominently on the surface and had not been noted before, or at least they had never been staked; so the Armstrong showings constituted a new discovery. The next year a number of claims lying between the *Proserpine* group and *Independence* group and joining on to the latter were staked by Carey, Blair & Tregillus. Continuations of the veins on the Independence group are found on these other claims, besides which several smaller veins have been opened up. During the last two summers Carey,


Conklin gulch
WILKINSON
PROSERPINE WEST (S. Baker)
PROSERPINE (S. Baker)
CONKLIN (S. Baker)
PROSERPINE EAST (S. Baker)
PROSERPINE SOUTH (S. Baker)
MOUSE (B. C. & T.)
BRITISHER
BLIGHTY (J. Nichol.)
WARSPITE
GEN. CURRIE (J. A. Macpherson)
TIPPERARY (B.C. & T.)
ANZAC (B. C. & T.)
KITCHENER (B.C. & T.)
GROUSE (R. A Pryce)
VIMY RIDGE (B.C. & T.)
FRISCO (W Thomson)
INDEPENDENCE
RELIANCE (J Thomson)
HARD CASH (Armstrong)
DISCOVERY (Armstrong)
APEX (J. Thomson)
McCallum gulch
Williams creek valley
Grouse cr.
Trail
Adits
Armstrong's cabin (Armstrong)
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PROSERPINE MTN.
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Blair & Tregillus have worked on the claims and have accomplished considerable in the way of surface work.

These quartz properties on Proserpine mountain were reported on in last year's Annual Report, but were re-examined in 1918 in greater detail. The owners, while unable to carry out any extensive developments, have succeeded by their own work in opening up the veins at a number of different places and generally have improved the showings on the properties. All development so far has been by surface work, with the exception of one shaft started in the fall, which was put down to a depth of 25 feet, and during the winter may have been sunk farther.

There are a number of well-defined quartz veins on these claims varying in width from 1 to 30 feet. These veins are mineralized in places with pyrite, arsenopyrite, and a little galena. The main valuable metal content is gold, the distribution of which is somewhat irregular. It would seem probable that the gold primarily was associated with the sulphides, but surface oxidation and leaching have in places scattered free gold through the quartz.

From the results of many samples taken, it is evident that at least portions of the veins would pay to work, and it is quite possible that further development would show considerable tonnages of ore which would pay to mill. The ore will have to be milled on the ground, and much further development is required before a large mill would be warranted. The possibilities for these claims are that when the veins are properly opened up they will furnish sufficient tonnage to mine and mill on quite a large scale, although average values may prove to be comparatively low grade. These properties warrant a thorough investigation by any company looking for gold properties.

Independence Group.

This group consists of three claims owned by E. E. Armstrong. They cover a portion of Proserpine mountain and extend a short distance across Grouse creek and up the eastern side. There are two main veins on the property approximately parallel and known as No. 1 and No. 2. These veins stand vertical, have a north-westerly strike, and are from 100 to 150 feet apart. No. 1 vein consists of alternating bands of quartz and schist; the total width between walls in one place is about 30 feet, of which one-half to two-thirds is quartz. Galena and pyrite occur in the quartz, but in small quantities, and a little pyrite is scattered through the schist. By surface cuts the vein has been prospected along its strike for a few hundred feet. The following samples were taken in the big cut on the vein: Across 28 feet (1917): Gold, 0.8 oz. Across 3 feet west side next to foot-wall: Gold, 1.1 oz. Across 7 feet east side next to foot-wall: Gold, 1 oz.; selected sulphide, gold, 2.24 oz. These results are decidedly encouraging and show the vein is worth serious development. The owner, however, has put in most of his work on the No. 2 vein, believing it to carry higher-grade ore.

No. 2 vein is developed by a series of cuts and shafts from 10 to 15 feet deep, which expose the quartz here and there for several hundred feet along the strike. The width of this vein is from 10 to 15 feet, and, as a rule, there are not many bands of schist mixed with the quartz.

Near the boundary-line of the *Independence* and *Kitchener* claims a shaft has been sunk 15 feet. A sample across 13½ feet at the bottom assayed: Gold, 0.32 oz.; silver, 0.6 oz. A grab sample from the dump gave 0.46 oz. gold, and another from a smaller pile of selected "rich dirt" went 0.60 oz.

Some distance to the south-east of the shaft there are three cuts on the vein, all within a distance of 50 feet. These show from 10 to 15 feet of quartz—as a rule, oxidized and iron-stained, and containing only small bunches of schist enclosed in the quartz. Some pockets of honeycomb schist, which is schist that has had pyrite in it, but removed by oxidation, is very rich; a selected sample of it assayed 13.44 oz. in gold. The following table shows the results of samples taken from these cuts and well illustrates the variable nature of the gold content:—

Description.	Width sampled.	Gold.	Silver.
	Feet.	Oz.	Oz.
First cut, east side	8½	Trace	Trace
Second cut, east side	10	Trace	Trace
Third cut, west side	10	1.24	0.2
Third cut	5½	0.4	Trace
First cut	Grab sample, dump	0.16	4.3
Third cut	Grab sample, dump	0.06	0.2
Selected honeycomb	.....	13.44	2.2
Selected oxidized arsenopyrite	.....	4.62	1.0
Special sample	.....	24.54	3.4

Five hundred feet to the north-east and on the *Hard Cash* claim a small surface cut shows the vein again, consisting of 4 feet of barren-looking quartz. A sample of it returned 0.08 oz. gold.

There are a good many places on the property where surface work has been done, of which no description is given, as it is unnecessary. It is sufficient to say that there are two large well-defined veins carrying variable gold values, and only systematic development and sampling will tell whether all or portions of the veins will pay to work.

Two veins crop out in the gulch of Grouse creek, and years ago short tunnels were driven upon them. These are distant about 2,000 feet and 800 feet lower in elevation from the main showings on the *Independence* claim, but are in about the right position to be continuations of the *Independence* veins. Apparently the average values in the quartz at this point are quite low, but here also assays of 1 oz. of gold to the ton have been obtained.

Tipperary. On this claim, which adjoins the *Kitchener*, a small cut shows a vein 3 to 4 feet wide striking north-west. The quartz carries arsenical iron and galena disseminated throughout in small amounts. A rough sample of the vein assayed: Gold, 0.08 oz.; silver, 11 oz. Another vein of rather glassy-looking quartz is exposed on this claim. It is from 8 to 10 feet wide and only in one place does it show a little galena and arsenical iron. An assay of some of it only returned 80 cents in gold and 1.6 oz. silver to the ton. This vein apparently strikes north-westerly with the formation.

Kitchener. This claim, owned by Carey, Blair & Tregillus, adjoins the *Independence* to the north-west. The showings on the claim are close to the line and near the shaft on No. 2 vein on the *Independence*. These two claims expose this No. 2 vein for a few hundred feet along its strike. An open-cut 20 feet in length shows a width of 20 feet of quartz and schist and in the former small amounts of arsenopyrite and galena. A sample across 4 feet of quartz returned on assay: Gold, 0.30 oz.; while a grab sample of the dump gave 0.10 oz. gold.

Warspite. This claim, owned by Carey, Blair & Tregillus, adjoins the *Tipperary* to the north-east. Several open-cuts show an irregular vein made up of alternating bands of quartz and schist. The formation apparently runs south-east at this point, with the vein cutting it in an east and west (mag.) direction. A sample across 4 feet in one cut assayed $4.80 in gold to the ton. A big cut 50 feet in length shows a number of bands of quartz and schist. A sample across 4 feet assayed $28 in gold, and a sample across the adjoining 18 inches gave $18.40 to the ton. A rough grab sample from the quartz on the dump went $4.40.

The main showing on the *Warspite* is a large irregular-shaped opening roughly 20 x 10 feet and 8 feet deep in the deepest place. This shows a vein of 6 to 8 feet of fairly clean quartz and sulphides. There are some small lenses of schist occurring in the quartz and some cross-stringers branching out from the main body of quartz.

The quartz is mineralized with pyrite and arsenopyrite and small quantities of galena. The amount of sulphides, however, does not form more than a small percentage of the total vein-filling. Considerable oxidation of the sulphides has taken place and the quartz is in many places loose and crumbly. The whole vein is heavily stained with iron-rust. This oxidation is apparently a surface condition and may be expected to stop as soon as a little depth is attained. Specimens showing free gold occur frequently in this open-cut.

This large cut was thoroughly sampled, the results being shown in the following table:—

Description.	Gold.	Silver.
	Oz.	Oz.
Across 5½ feet east side of cut	0.18	2.5
Across 22 inches of schist on wall	Trace	Trace
Across 17 inches of cross-stringer	0.76	0.05
Across 5 feet near centre of cut	0.05	0.6
Across 1 foot adjoining last sample of high grade streak	1.2	0.3
Across 9 feet west side of cut	1.38	0.4
Across 6 feet near centre of cut	0.8	0.4
Grab sample of dump	1.0	1.0
Selected arsenopyrite, quartz, and some galena	9.6	39.6

Taking the average of the first six samples by multiplying the width sampled and assay in gold and then averaging to the foot of vein sampled, the result is 0.99 oz. gold to the ton, which happens to check somewhat remarkably with the grab sample from the whole dump of 1 oz.

Another vein is exposed on the *Warspite* which apparently strikes S. 55° W. (mag.), although the small opening makes it difficult to tell much about it. There is here exposed about 20 inches of quartz fairly well mineralized with galena, pyrite, and arsenopyrite. A rough sample of the vein gave: Gold, 0.8 oz.; silver, 8.3 oz.

Alladin.

This claim is situated on the northern flank of Stouts gulch on Barkerville mountain, three-quarters of a mile from Barkerville and 300 feet above the town. The owner is Dr. Callaghan, of Barkerville. An open-cut 25 feet long with a 6-foot face shows a quartz vein 6 feet wide striking N. 70° W .in schist. A sample of the quartz on assay only showed traces of gold and silver. Four hundred feet to the north-west another cut shows the vein to consist of interbanded stringers of schist and quartz. A sample across 3½ feet returned: Gold, 0.08 oz.; silver, 0.2 oz.

Another vein on the property consists of parallel quartz stringers in schist, with cross-stringers radiating out from the others. A general sample of the vein only returned traces, but a sample from a 6-inch stringer which was reported to "pan well" assayed 4.48 oz. in gold. Another from a 10-inch stringer carried 0.62 oz. gold to the ton.

Hardscrabble Scheelite Deposit.

Introductory.—The property known as the "Hardscrabble Scheelite Deposit" consists of two Crown-granted mineral claims; it is owned by a syndicate of six men, of which J. A. Macpherson, of Stanley, and D. McCaskill, of Vancouver, seem to be most heavily interested.

The claims are situated on Hardscrabble creek, half a mile above the junction of this creek with Willow river. The property is distant about sixteen miles from Stanley. From Stanley the main Barkerville wagon-road is followed to Jack of Clubs lake, and from there a branch road extends to Mosquito creek, a distance of one mile. From this point to the property it is four miles, the first three miles being over a rough road which was built to serve claims on Sugar creek. One mile of new wagon-road and a small expenditure for repairs would give the property good wagon transportation to Quesnel, a distance of fifty-eight miles. From Quesnel there is river transportation to Prince George, on the Grand Trunk Pacific Railway.

Hardscrabble creek was worked in a small way for placer gold many years ago. In the course of the drifting operations small pieces of heavy white and brown minerals were found in the gravel and also in small amounts in the sluice-boxes. This mineral was finally identified as scheelite. Later in the drifting operations the scheelite was found in stringers in-place in the bed-rock; a drift in the bed-rock was run and a shaft sunk for the purpose of exploring the scheelite-deposit. This work was done some years ago and since then no further development has been carried out. Last year the workings were cleaned out and fixed by Mr. Macpherson, so that the showings could be examined.

Workings.—Entrance to the workings is by a shaft 60 feet deep, from which a drift extends northerly for 153 feet. At this point a winze has been sunk to a depth of 20 feet, and a drift run to the east for 49 feet. The main shaft is in gravel throughout, and the main drift north is in gravel for half its distance before breaking into solid rock.

Thirty feet below these workings a drain-tunnel 1,900 feet in length was driven from near Willow river. This was part of the placer operations and was driven to draw the water from the gravel to facilitate the workings of the placer-gravel. South of the main shaft an opening downward connects with this drain-tunnel and the water is carried off. Above the main workings numerous gravel-drifts have been made in the course of mining out the auriferous gravel.

Ore-showings.—The main showing of scheelite occurs along the first 15 feet of the east drift commencing at the winze. The country-rock is a schist, in places highly micaceous. The strike is approximately N. 60° E. (mag.), with a dip to the north. The east drift follows approximately the strike of the schist country-rock.

The scheelite apparently occurs in irregular stringers and bunches. There would seem to be two main series of fractures, one striking N. 60° E. (mag.) with the formation, and the other north and south (mag.). Of these the latter would seem to be the more important, and in all cases noted they cut the stringers running with the formation.

With the limited development-work done and entire absence of surface exposures, it is difficult to ascertain the true strike of this scheelite-bearing zone. It would seem, though, that the schist had been slightly fractured in the first place along a line of N. 60° E. (mag.) and some quartz deposited in the fractures. Later this schist has been fractured along a north-and-south line, and in these fractures quartz, calcite, and scheelite have been deposited. From these fractures some scheelite has been fed into the quartz stringers running N. 60° E. (mag.), this giving rise to the opinion that the scheelite-zone followed the formation. More work is necessary to determine definitely the true strike of the zone.

In addition to the mineral already noted, a little pyrite and galena occur in the stringers, but not in appreciable amounts. Wolframite, tungstite, and molybdenite are said to have been found in the deposit, but none were seen by the writer.

The stringers are narrow, from 1 inch up to possibly 6 inches. In 12 feet of rock-matter six stringers running north and south (mag.) were seen. The stringers running in the other direction are very irregular and are more in the nature of bunches.

The schistose and quartzose rock-matter between the stringers is said to carry a little scheelite, but this is not visible to the eye. A sample taken to determine this point, on assay, showed no trace of tungsten. It is improbable that the schistose rock carries any appreciable percentages in tungsten, so that from an economic view-point only the narrow stringers carrying scheelite need be considered.

Values.—The small stringers carry small bunches of scheelite which in places are pure mineral. Assays of these selected specimens would therefore give high results. If 6 to 10 feet of the scheelite-bearing zone were mined out the tungsten content would undoubtedly prove to be quite low, although possibly sufficiently high to be economically worked. Selective mining and hand-sorting of the pure scheelite might yield a small production.

The property is at present quite undeveloped and some further work should be done before intelligent and exact sampling can be done. With the present price of tungsten, the indications of tungsten-bearing ore in this property are such as to warrant some further development to ascertain the extent of the mineralized zone.

QUESNEL MINING DIVISION.

Quesnel Mining Division was at one time the scene of important and productive placer operations, but in recent years the industry has declined until the annual output only amounts to from $10,000 to $20,000. In the early years of the Cariboo gold-rush the Quesnel Forks-Keithley country was very actively worked. Later on, several large-scale operations were commenced at different places around Quesnel Forks and Harpers camp. These were worked for varying lengths of time and eventually closed down.

The most famous of these and up to that time the most important hydraulic-mining enterprise in British Columbia was that of the Consolidated Cariboo Hydraulic Mining Company, more familiarly known as the "Bullion" pit. This property has been tied up for the last five years in litigation over ownership, but it is probable that when this is settled operation will recommence.

At the present time there are only a few men left at Quesnel Forks, and in the whole of the area around there is no placer-mining going on. On Keithley creek one property is being worked in a small way.

On the Quesnel river the 20-Mile hydraulic plant is being operated. At Harpers camp there was a little activity during 1918, consisting of the installation of the plant of the International Dredging Company. Up the Horsefly river, at Black creek, some Keystone-drilling was done but, with inconclusive results.

HORSEFLY SECTION.

Proposed Keystone-drilling at Harpers Camp.

Introductory.—Harpers camp is situated on the Horsefly river, thirty-five miles in an easterly direction from 150-Mile House on the Cariboo Road. A weekly stage from 150-Mile gives access to the camp. The history of placer-mining in this section is much the same as in other parts of the Cariboo District, viz.: First, vigorous mining in the early sixties of the easily available rich ground; secondly, intermittent mining by Chinamen and others; and, thirdly, working of the ground on a larger scale with the aid of modern machinery.

International Dredging Co.'s Dredge.

International Dredging Co.'s Steam Plant.

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The important productive ground near Harpers camp was an area lying in and along a bend of the Horsefly river, and consisting in all of not more than 10 acres. The estimates of the amount of gold taken from this area vary considerably, ranging from $500,000 to $1,250,000. This ground was first drifted by the old-timers, and was eventually worked by R. T. Ward by hydraulic methods and using an hydraulic elevator to raise the gravel from pits to the sluice-boxes. It is quite certain that the early work paid handsomely, but it is difficult to ascertain whether or not any profit resulted from the operations of R. T. Ward. Some portions of the ground paid, but others did not, and the whole average result is unknown. It must be remembered, though, that the Ward ground had the best of the gold taken out by the old-timers.

It is believed by some of those familiar with the work done at Ward's Horsefly that there is still some unworked ground left in this area which will pay to work. With the idea of reworking this ground the International Dredging Company was formed three years ago. This company has spent three seasons in preparation and has only commenced active operations this year.

The plan of operations is to dig and elevate the gravel by a scraper operated by a powerful donkey-engine. The gravel is elevated, washed in sluice-boxes, and an undercurrent product treated in a patent rocker. To begin with, the ground handled will consist of old tailings, which it is claimed carry sufficient gold to pay operating expenses, and eventually new ground will be reached. The operations of this company are described in more detail later in this report.

The character of the gold taken from this ground (known as Ward's Horsefly) was uniformly fine, flat, and well worn; grains the size of flax-seed formed the greater portion of the gold taken out. It is quite evident that the gold in this area of ground had travelled a considerable distance and is not of local origin. Presumably it had its origin at some unknown point away up the Horsefly river.

The Horsefly river, both above and below Ward's Horsefly, has been fairly thoroughly prospected and a little gold has been taken out in places; no place comparable in richness with the Ward ground has, however, been found. The conclusion has therefore been reached by many that the gold in Ward's Horsefly did not get there by following the present river-channel. An old channel of the river is postulated in order to account for this remarkably rich spot with barren ground above and below.

Some work has been done to prospect the adjacent territory for this supposed old channel, but it is claimed that this work, while unsuccessful in finding gold, has not been sufficiently extensive to settle the matter definitely.

A considerable amount of money was spent in what is known as the "Miocene" shaft. This enterprise was carried out by the Miocene Gravel Mining Company with the expectation of finding a continuation of the rich channel worked at Ward's Horsefly.

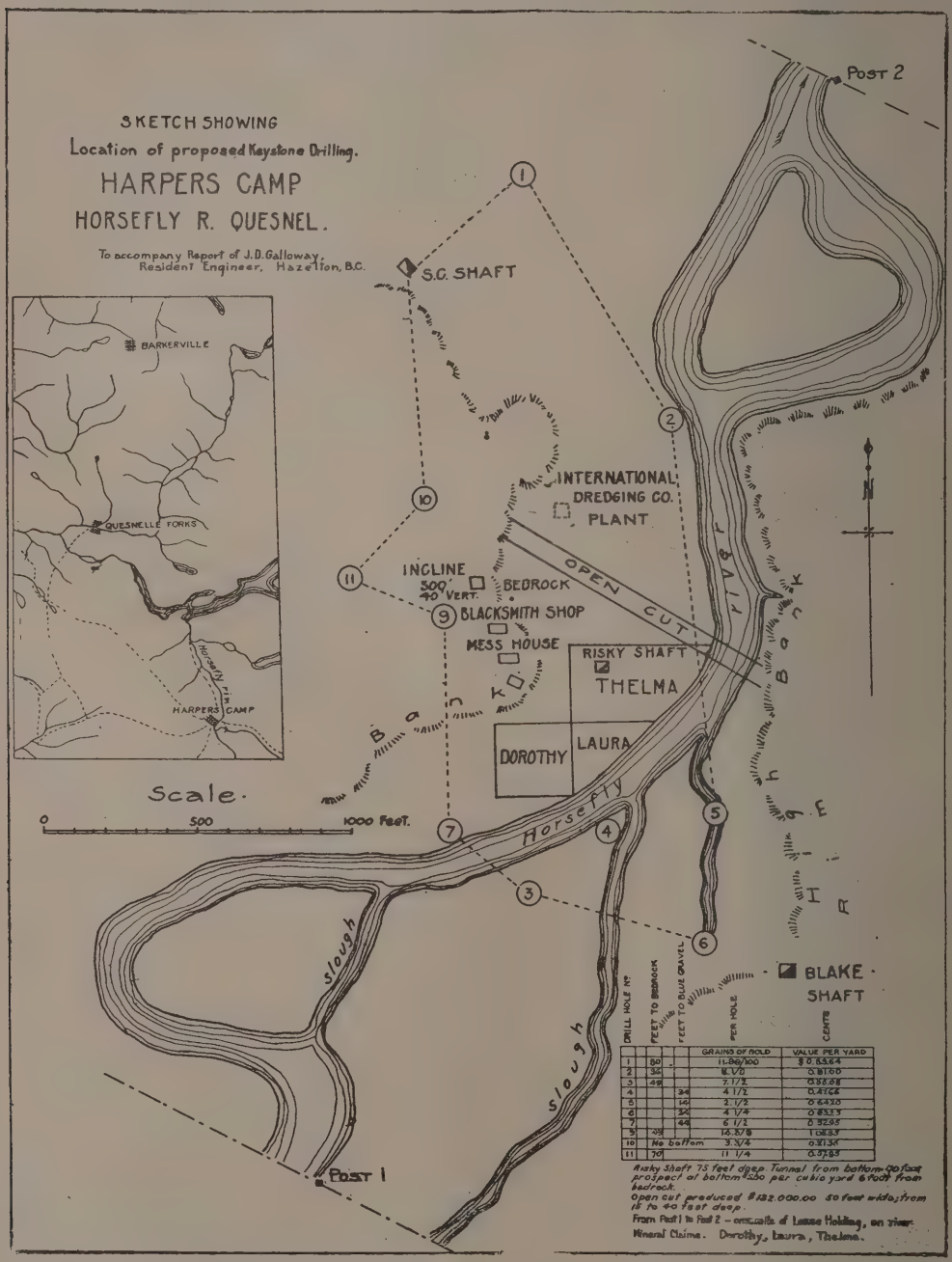
The main shaft was sunk at a point about one-third of a mile south of Ward's Horsefly pit; it was put down 500 feet before striking bed-rock. The whole work was well done, the shaft being 3-compartment and well timbered and the machinery complete for the purpose. In sinking this shaft the gravel was found to be capped with about 100 feet of blue clay, after which about 400 feet of gravel was passed through, containing gold, but not in paying quantities. This gravel is free and very uniform in size, being composed almost entirely of smooth, worn, white quartz pebbles. In this it differs materially from the wash as seen at Ward's Horsefly, which is bluish in general colour and contains many different rocks besides quartz pebbles.

During the spring of 1900 the pumps, pumping-station, and machinery generally were overhauled and the shaft sunk 50 feet deeper in bed-rock. From this level a drift was run for 500 feet in the direction of and under the channel. From this rock drift upraises were made into the gravel-channel. When the last upraise was put up which struck gravel in 15 feet, the rush of water and gravel flooded the workings. Since this occurred no further work has ever been done in the shaft.

Reports vary as to the gold-tenure of the gravel taken from the upraises into the channel, but it would seem that it at least contained some gold and in places sufficient to pay to work. The "sampling" of the channel by means of breaking into the gravel with three or four upraises was quite insufficient to form any proper estimate of the average gold values in this channel. It is to be regretted that when so much capital was expended in this enterprise the testing of the channel was not carried further.

Some drilling has also been done in the vicinity which will be described later, and also some attempts were made at sinking shafts by hand where the ground was supposed to be shallow.

Five miles down the Horsefly river "Hobson's Horsefly" is situated. This was a hydraulic pit equipped and operated on a large scale by J. B. Hobson. The deposit of gravel worked here



lies only a short distance from the Horsefly river and represents a former channel of the stream. The project was unsuccessful owing to the outside gravel changing to a cemented gravel, which is virtually a conglomerate. Hydraulicking was therefore of no avail and a small stamp-mill

was erected to grind the cemented gravel. It was obvious that unless the ground was extremely rich placer-ground it would not pay to operate in this way. The mill was only operated a very short time when work was finally stopped.

The presence of a former channel of the Horsefly river at Hobson's Horsefly strengthens the theories that in other places (as, for instance, near Harpers camp) the present channel is in part diverted from the old channel down which the richest gold-bearing gravels were transported.

Physical Features.—Attached to this report is a map showing that portion of the Horsefly river which includes Ward's Horsefly pit and adjacent territory, and the location of drill-holes already put down in former years. The country is flat, except that the river cuts down 20 to 30 feet below the general level. The grade of the river is slight, not sufficient to carry off hydraulic tailings. In all the work done here it has been necessary to elevate the gravel in order to make an artificial dump.

In the Ward workings the bed-rock was found at depths varying from 20 to 60 feet depth. The bed-rock that can be seen now in certain places is so decomposed and softened into clay and sand that it would seem doubtful that it is the true bed-rock, but those familiar with the work while it was in progress say it was more rock-like in character when first exposed. From a point near the centre of Ward's Horsefly the bed-rock dips off in all directions; at the Miocene shaft the depth is about 500 feet, and in other directions the depths are unknown at any great distance from the pit. The way in which the gold occurs here on the highest bed-rock is somewhat puzzling and accounts to some extent for the different ideas as to where it came from.

The pay-strata in Ward's Horsefly is locally called "blue gravel." It has a thickness of 5 to 20 feet, resting on the bed-rock. Concentrations of gold on bed-rock were of frequent occurrence. This blue gravel is not particularly hard and presents no serious difficulties in mining. Above this blue gravel are other stratas of clay and gravel carrying in places some gold. It is impossible now to get any exact estimate on how the gold was distributed in the gravel, average yardage value, etc.

Provided a continuation of pay-gravel beyond Ward's Horsefly pit was found, it is doubtful how the ground could be worked. All the evidence available indicates that the ground would be deep. Straight hydraulicking cannot be carried out in this area owing to lack of dump. Hydraulic elevators are never very satisfactory and cannot be operated to any great depth. Drifting operations to be successful must have rich ground; i.e., the values must be concentrated in one thin strata and not be disseminated through a great thickness of gravel. Ground deeper than 80 feet could not be worked by dredging.

Previous Drilling.—As shown by the attached plan, ten holes (numbered 1 to 11, with No. 8 missing) were put down around Ward's Horsefly pit. This work was done by some Eastern syndicate. The following table shows the average values said to have been obtained in these holes, but no guarantee can be given as to the accuracy of these figures:—

Drill-hole No.	Feet to Bed-rock.	Feet to Blue Gravel.	Value per Yard.
			Cents.
1	80	..	53.64
2	36	..	81.00
3	49	..	55.08
4	..	34	47.66
5	..	14	64.20
6	..	24	63.75
7	..	44	52.95
9	49	..	105.55
10	No bottom	..	21.35
11	70	..	57.85

The above values are quite high, and if correct would show the ground to be first-class dredging-ground. The depth of ground is also within the dredging limit. No reason is known why the Eastern syndicate stopped drilling and gave up the investigation of the ground. No reliance can be placed on any values obtained by drilling unless the work is carefully done by an experienced driller and an exact log of the hole kept.

The scraper system of mining (which may be considered a dredging operation) now being operated by the International Dredging Company should be able to handle the ground included in the drill-holes shown, and if the values are as claimed a fair margin of profit should be made.

Proposed Drilling.—The ground Mr. Campbell wishes to drill lies across the river to the east of Ward's Horsefly pit. A depression extending for a considerable distance in this direction is believed by him to be an old channel of the Horsefly river. This is virgin ground and nothing is known of it one way or another. Some shafts have been attempted near the bank of the river, but none reached bed-rock. Drilling of the ground would undoubtedly settle the matter as to whether or not there was an old channel in this direction. Before doing any extensive drilling a detail topographic map of the area would be of considerable value, and some time should be spent in an examination of the surrounding country.

Ownership of Ground.—So far as was ascertained, the only locations held in this locality are three creek claims (250 feet each) owned by the International Dredging Company, which occupy part of the old Ward's Horsefly pit, and a dredging lease along the river held by R. T. Ward; this lease (No. 1360) is subleased to the International Company. Application for a dredging lease adjoining Ward's lease down the river has been made by Williams, who also has a pre-emption covering the ground to which he has just secured title. The ground Campbell proposes to drill has not as yet been leased to anybody.

Conclusion.—Following are the main facts known regarding the occurrence of placer gold at Ward's Horsefly:—

(1.) The ground worked was very rich, probably nearly $1,000,000 being taken out of a small area of 8 to 10 acres.

(2.) Ground on the river immediately above and below this pit has been found to be practically barren of gold.

(3.) The character of the gold obtained in Ward's Horsefly is such that it is certain that it must have been transported a considerable distance.

(4.) It is unlikely that such a concentration of gold would occur at one point without a feeding channel coming into it. Such channel, however, may not carry much gold, as the local conditions at a particular point may cause a concentration of gold at that place.

(5.) All prospecting and testing of ground adjacent to Ward's Horsefly have been unsuccessful.

(6.) Several places which could possibly lie along the line of the supposed old channel have not yet been tested. From a purely business standpoint there has not apparently been sufficient chance of success in this proposition to make it worth while spending the money required to carry out a systematic campaign of drilling; consequently if left to private enterprise it is unlikely that any further work would be done in this area, and therefore the only hope left is for the Government to do some drilling. The justification for the Government doing such work is that, if successful, a productive placer camp would be re-established.

If, however, the Government decides on the policy of doing this drilling in the interests of the country, then it would be desirable that a further and more extended examination be made and the drilling laid out on a definite plan. The drilling will be of no value unless carefully supervised and results kept in such a way that they will be accepted as a correct record of the value of the ground.

International Dredging and Exploration Company.

This company was incorporated about four years ago for the purpose of working placer-ground at Harpers camp by a new system—the Stanley scraper, a patented process. The company was mainly financed in Victoria, B.C. The ground to be worked, consisting of three creek claims and a sublease on dredging lease No. 1360 on the Horsefly river, is at Harper's camp, practically on the site of the old Ward's Horsefly.

This ground in part covers the small area at Harpers camp which in the past was so highly productive. It is believed that some equally rich ground still remains to be worked in this area, but before getting to this an accumulation of tailings will first have to be worked through. It was believed that by the use of improved gold-saving devices some values might be recovered from these tailings, but this is by no means certain.

As is usual in such an enterprise, difficulties were encountered which were not foreseen to begin with, and so, although the company has been working during the past three seasons getting things in shape, only in the summer of 1918 was the plant ready to operate. The mechanical part of the plant now consists of a 100-horse-power upright boiler, a 40-horse-power double-cylinder Empire 2-drum engine, and the Stanley scraper with cables, blocks, etc.

The Stanley scraper is somewhat like an enlarged horse-scraper, with sharp teeth for cutting in and longer sides than the bottom. It is of heavy construction throughout and has a capacity of 2 cubic yards. By means of cables, blocks, and poles this scraper can be moved backwards and forwards by the engine. It is fitted with a double haulback, so that it can be "spotted" anywhere within the triangle that is being worked. This scraper will haul gravel 500 to 600 feet and should dig down 40 feet in depth or more. The scraper drags its load up a gradual incline and delivers it to a sluice in which a sufficient head of water is running to carry off the gravel, the gold being caught in the riffles. The scraper takes about two to three minutes for a round trip and should handle 750 yards in twenty-four hours.

The plant was operated for a short time in 1918, working entirely on tailings. The recovery of gold is not known, but it is not believed these tailings yielded any appreciable amount. Work will be resumed next year, and it is expected gravel will be reached which has not previously been sluiced.

The water-supply is obtained from Moffatt creek. An old ditch-line was repaired and renewed, bringing the water to a smal lake near Harpers camp, which has been converted into a reservoir by building a dam at the outlet. This water system will supply from 500 to 1,000 miners' inches of water.

Black Creek.

Black creek is a small tributary of Horsefly river, coming in some twenty miles above Harpers camp. This creek was prospected for placer gold many years ago, but from the conflicting accounts it is hard to determine how successful these early attempts were. It seems fairly certain, however, that no very rich ground was found and that the quantity of gold recovered was small. The old workings, which are not extensive, are in several places from one to two miles up-stream from where the creek joins the Horsefly river.

Early in 1918 the Western Mines Exploration Syndicate, of Vancouver, for which Mr. Turner is engineer, secured leases on the creek with a view to testing the value of the ground. The testing of the ground was recommended by Phil Fraser, an old-timer in the district who had worked on the creek, and also had been in charge of work at Harpers camp many years ago. Fraser considers that an ancient channel of the Horsefly river lies upon the bench and at 1,000 feet higher elevation than the present river. His idea is that Black creek cut through this old channel and thereby obtained the gold found in its gravels, and that if this old channel could be found it would prove very rich. There is very little material evidence, other than a slight depression along the bench, to support this theory of an old channel of the Horsefly existing at this place.

The first work of the syndicate was an attempt to prove the correctness or otherwise of Fraser's old-channel theory. A Keystone drill, then owned by R. T. Ward, but since acquired by the Government, was taken up to the ground. This drill had been used some years ago lower down the creek.

Mr. Fraser was in charge of the work, and the site selected for the drilling was upon a bench some 80 feet above the creek on the south-easterly side and two miles up from the mouth of the stream. Five holes were put down running in a general direction up-stream, and therefore crossing the old channel which supposedly runs at right angles to Black creek.

This section of holes showed a slight depression to exist at this point, and the deepest hole at 81 feet failed to reach bed-rock, the shoe breaking at this depth. The other evidence, however, does not support the idea that there is an old stream-channel at this point. No appreciable gold values were found in the material drilled through. An examination of the logs of the holes showed that the material on the holes consisted of clays and gravels that might occur on any bench.

While the drilling was progressing an attempt was made to sink in the gravel by the bed of the creek in order to ascertain the values on bed-rock. On account of water it was found impossible to get down by hand-sinking more than 10 to 15 feet, so that no results could be obtained.

There is a considerable amount of gravel in and along Black creek which may carry sufficient gold to pay to hydraulic. The easiest way to test this ground would be by means of drilling with the Keystone drill. Black creek is small and would hardly supply enough water for large-size hydraulicking, but possibly during the high-water season sufficient water would be obtainable.

The creek has sufficient fall to provide dump-ground for tailings from hydraulic operations. Further testing of the gravel in and along Black creek may be carried out by the syndicate to determine whether the gold-tenure is sufficient to warrant the installation of a hydraulic plant.

Quesnel Hydraulic Gold Mining Company.

The Quesnel Hydraulic Gold Mining Company was promoted and organized by Howard DuBois to work on a large scale the immense gravel-deposits on Twenty-mile creek, a tributary of the Quesnel river which enters twenty miles below Quesnel Forks. Twenty-mile creek had been worked in a small way by both whites and Chinamen, but on account of a small supply of water only certain small areas were attacked. The assumption on which the Quesnel company went ahead was that the immense deposits of glacial gravels and clays on both sides of Twenty-mile creek all carried values, even though lower grade than the small patches previously worked. The problem as stated by Mr. DuBois was "not to find gold, but to find water." Some preliminary testing of the gravels was done by tunnelling and shaft-sinking on a small scale, and the results obtained apparently confirmed the opinion that the gravels carried sufficient values to pay to hydraulic on a large scale. The later operations, however, showed that the values were lower and more "spotted" than had been anticipated.

While making investigations in the Quesnel Division Mr. DuBois discovered a source of water-supply on upper Swift river that seemingly had been overlooked by others, and ascertained that it would be practicable to bring this water on to deposits of gravel on the Quesnel River slope.

About $1,000,000 was expended in putting in the water system and equipping the property. The water plant is the best in the Province, as it can easily supply 5,000 miners' inches at a head up to 400 feet for six or seven months in the year. Equipping of the property was completed in 1911, but the first real test of the gravel was the season's run of 1912. This test, however, was entirely unsatisfactory, as less than 2 cents a yard was recovered from the gravel handled instead of from 5 to 8 cents as had been expected. Operating costs were said to be about 1⅓ cents a yard; this low cost shows the mechanical excellence of the plant installed by Mr. DuBois.

The property was not operated in 1913 or 1914, but in 1915 further testing of the ground was commenced under the supervision of K. C. Laylander. This work has been continued each season since that time.

It has now been pretty well demonstrated that the great accumulation of gravels and clays through which the present Twenty-mile creek has cut is, as a whole, not sufficiently auriferous to pay to work. Certain terraces of gravel deposited in bays by the stream in its cutting-out process, which are really partial concentrations from the older gravels, do carry values. These, however, are relatively small in extent and are such areas as were worked by the old-timers. Furthermore, it is extremely doubtful whether the values saved in the small-scale testing of the ground in rockers, etc., can be saved in a short sluice carrying 3,000 or 4,000 miners' inches of water. A percentage of the values, possibly a large percentage, is in the form of flour gold which cannot be so saved in the ordinary hydraulic sluice. After the 1912 run some doubt was also expressed as to whether the method of working the pit had not left most of the values in the pit, as bed-rock was only reached and cleaned up in places. Mr. Laylander, the present manager, however, claims that working to bed-rock makes no appreciable increase in the value per yard recovered.

The work of the last few years has shown some areas of the gravel which will pay to work, but which will not show any great margin of profit. One pit is now being carried ahead with the idea of breaking into a supposed old channel lying at some distance from the present creek. During the season of 1918 the problem of recovering the total values in the gravel handled was attacked, the chief incentive to this being the idea that the black sand, which occurs in sparing quantities in the gravel, carried appreciable platinum values.

It has long been known that some of the black sand (a concentrate from the placer-gravels) in the Quesnel River district carried more or less platinum contents. The amount of this platinum is quite variable; many samples of black sand on assay do not show a trace, while occasionally quite high assays have been obtained. From many places up and down the Quesnel river and its tributaries platinum has been reported, generally in small amounts. No appreciable quantities of platinum were ever recovered from the placering operations in the Quesnel Division,

what platinum there is apparently occurring in almost microscopic grains with the black sand, which latter has seldom been saved. The presence of this platinum can rarely be detected by the eye, and it is only through assays of samples of the black sand that its occurrence has been noted. The Annual Report for 1902, page 64, gives a list of such assays, with localities. These assays were made on a number of samples of black sand the ratio of concentration of which was quite unknown, so that they only indicate the presence of platinum in the gravels without giving any idea of the value to the yard. It may be well to point out here that the usual small quantity (amounting often to about an ounce or less) of black sand obtained from panning a full pan of gravel represents a very high degree of concentration—say, 1,000 to 1. It follows, therefore, that the platinum content in the black-sand concentrate must be quite high before the value per cubic yard of gravel becomes of commercial importance.

From a number of samples of black sand taken in 1917 from the hydraulic pit at Twenty-mile, assayers in the United States returned varying amounts of platinum. Granting that the samples were representative and the assays accurate, the platinum content of the gravels was of importance; in addition, the assays showed a considerable gold content in the samples.

Mr. Laylander therefore decided during the season of 1918 to recover the black sand in a commercial way with a view to making a thorough determination of the flour gold and platinum contents. The hydraulic pit was operated as usual with a large head of water, but an under-current was put in the sluice-box by means of which a portion of the fine material passing through the sluice was drawn off through a grizzly. This material, consisting of fine gravel and sand, is elevated in an hydraulic elevator to a mill where it is treated.

In the mill the gravel and sand is fed to two Neal jigs, which make a partial concentration. These jigs are of a special design recently patented for use on California gold-dredges as part of a process to recover black sand. This jig is fitted with a 30-mesh screen on which there is a layer of chilled shot. Underneath this screen a set of paddles moves back and forth, giving rise to an alternate lifting and suction of the material on the screen. The material to be treated is fed into the jig and forms a layer on top of the chilled shot. A continuous flow of water fed in with the gravel keeps the jig-box full of water and the overflow carries off the tailings. The fine heavy particles sink and are drawn through the layer of shot and finally through the screen, forming a hutch product which is the concentrate from the jig.

The capacity of a Neal jig working on this class of material is about 40 tons a day. The concentrate is continuously discharged to a dewatering-cone, from which it feeds to an Overstrom table, one table handling the product of the two jigs. A clean concentrate of black sand is made on the table without difficulty. The amount of black sand in the gravel-deposit varies considerably, some strata yielding a fair percentage and others practically none. During the season the production of the mill was from ¼ to ½ ton a day of black sand. Only a small proportion, however, of the fine material passing through the hydraulic sluice was recovered.

The mill is run by a Pelton wheel, a short pipe from the main pipe-line supplying the water. A 5-horse-power electric generator has been installed for lighting purposes.

The average values which this black sand contains in gold and platinum are still undetermined, for while some high assays have been obtained, others show only traces of these metals. Tests are now being carried out to find the average value of this concentrate, of which a considerable quantity was secured during the season, and also as to how these values can be extracted.

Keithley Section.

Keithley creek is one of the famous placer-creeks of the early Cariboo gold excitement, and is credited with a production of about $6,000,000 from a distance of eight miles up the stream from its mouth. Above this point there is a falls on the creek, and beyond the falls practically no gold was ever taken out. The most of the gold from the creek was flattened and well worn, about the size of flattened grains of wheat, although occasionally coarse nuggets were found. Practically no black sand is found as a concentrate from panning the gravel anywhere on the creek and platinum has never been reported.

The most of the gold from Keithley was taken out from the present creek-bed by cleaning up the stream-gravels to bed-rock. In addition, an old channel on the bench on the north-east side of the stream was worked and in places yielded very rich "pay." This channel was very erratic, so that it has only been worked in certain places at irregular intervals.

Kitchener.

This placer claim is situated on Keithley creek one mile above the mouth. It is owned by R. W. Harrison and E. J. Worth, but has been operated by Harrison alone for the last three years, his partner having enlisted shortly after the outbreak of the war. The property consists of one 1,500-foot lease and one record claim. Work was commenced in October, 1914, and has been carried on more or less continuously since.

The Kitchener workings are on the old channel 130 feet above the creek. The channel here is irregular and would appear to have somewhat the shape of the letter S. Many years ago the ground was held as the *Howick* claim, but a new portion of the channel is being worked by Harrison. The workings on the *Howick* claim were never very productive. A short distance up-stream was the old *Onward* claim, which yielded big pay.

The first working by Harrison is a tunnel driven in 300 feet, which was successful in finding the old channel. A lot of ground has been drifted out from this tunnel and is said to have averaged 5 oz. to a set. The ground, however, was hard to handle and the mining expenses were unduly high in consequence. Eventually work was stopped on account of heavy ground and water-pressure.

Another tunnel was started then a short distance down-stream from the other one. On October 14th this was in 130 feet and the driving of it ahead was being continued. This tunnel is for the most part driven in rock, but the last part is partly in gravel, there being about 2 feet of gravel carried along at the face. This gravel, it is claimed, carries about 2 oz. to the set, the sets having a 10-foot cap. The gravel consists partly of well-worn stream-gravel and partly of sharp angular fragments of rock, very similar to talus material.

As far as can be ascertained, many of the attempts to find this old channel along the bench were unsuccessful, but there seems to be a strong probability that the channel is continuous, although somewhat broken and irregular. There may therefore still be plenty of pay-ground left to work. The most satisfactory way of testing the ground would be by Keystone-drilling. The ground held by Harrison and other parts of the same channel could best be worked by hydraulicking. Keithley creek carries plenty of water even in the lowest stage for large-scale hydraulicking. With two miles and a half of ditch and flume a head of over 200 feet could be obtained. There is an excellent dump in the 100-foot drop from the bench to the creek and the stream itself has a sharp descent. The expense of installing an adequate hydraulic plant on this creek would be, comparatively speaking, quite low. This proposition is well worth examination and detailed investigation.

CARIBOO DISTRICT.

CARIBOO MINING DIVISION.

Report by L. A. Dodd, Gold Commissioner.

I have the honour to submit herewith my annual report on the progress of the mining industry in the Cariboo Mining Division for the year ending December 31st, 1918.

Owing to having only arrived in the district in July and my previous non-acquaintance with the district except in a very general way, I am not in a position to go so thoroughly into conditions as I should desire, but as the Resident Engineer, J. D. Galloway, has made two visits to the district this year, and a Dominion Geological Survey party under B. R. MacKay spent some months in preliminary work, their reports will, if consulted, be found to cover all operations in a much more instructive and technical manner than I could hope to.

Owing to the very late season hydraulic operations were greatly impeded. When the thaw did come, it arrived with a rush and miners obtained very little good from it. This, followed with a very dry summer and autumn, practically cut the season in two, and, as a consequence, hydraulic operators all report very poor results.

Stouts Gulch, *Lowhee Creek*, and *Mosquito Creek* properties, operated by John Hopp, only produced about half their usual averages.

Slough creek, operated by the Point Hydraulic Mining Company, Limited, had a short season with a fair output.

On Jack-of-Clubs creek, McDougall & Reed have sunk their shaft to a depth of 96 feet, and at time of writing have run their drift some 30 feet from the bottom of the shaft. They expect to have to go at least 70 feet farther with the drift, when they hope to tap the old channel.

On Williams creek Joule & Mason worked the old *First of May* property, but owing to water shortage the results were disappointing.

On Grouse creek the old Waverly Company, reorganized, did considerable preliminary work, including the sinking of some test-holes, erecting sawmill, logging, etc., with a view to carrying on active mining operations during the ensuing year.

On Antler creek Houser Bros. & Fraser have carried on development-work on the *Gold Seal Consolidated* group of leases, and a Vancouver syndicate has been doing preliminary work on Nugget gulch.

The Lightning Creek Hydraulic Mining Company, the West Canadian Deep Leads, the Thistle Gold Company, and the Cariboo-Chisholm Creek Mining Company were idle during the year, presumably owing to the shortage of labour, high cost of supplies, and fixed price of gold.

I. I. Felker reports on Perkins Gulch operations as follows: "During the three seasons previous to 1918 we worked out the channel next to the left rim for a length of 600 feet and a width of 150 feet. This work revealed no sign of the right-hand rim, so with the bank getting high and the pressure low, we decided to back up and open a new pit about 150 feet to the right. The present season's work has uncovered a channel 100 feet wide and 30 feet lower than the bed-rock in the old pit. The bank shows two strata of gold-bearing gravel—one pre-glacial deposit on the bed-rock 100 feet wide and 4 to 6 feet thick; the other, a post-glacial deposit, on top of a 20-foot layer of clay, 100 feet wide and 6 to 10 feet thick. These two deposits carry about equal values. The bed-rock gold is heavier, but the top gold is more smoothly washed. The top run is evidently the one that Sam Montgomery spent so much time in prospecting for. At the beginning of this season we installed a No. 2 plant in place of the No. 1, which materially increased the output. We had about five weeks' run with a full head in the spring, working four men. The remainder of the season we operated, using the reservoir, with only two men. Amount of gravel moved, 22,000 yards. Advanced the flume twelve boxes, added two boxes to dump end, which furnishes dump for season's work. Have dug a 2-foot ditch 440 yards downstream to catch water from springs and snow."

I have no information regarding operations in the Fraser River canyon, nor a report on the work carried on during the year by the Lightning Creek Gold Gravels and Drainage Company at Wingdam, beyond the current local knowledge that this work consisted largely of drilling.

In regard to quartz-mining, there have been quite a number of locations made, principally in the neighbourhood of Prince George, but the Deputy Mining Recorder at South Fort George informs me that beyond a little prospecting he can find nothing of importance to report on.

The holders of the Proserpine Mountain properties, E. E. Armstrong and Carey, Blair & Tregillus, are most optimistic, and since Mr. Galloway's last visit in October have erected a shaft-house and continued their shaft on the *Warspite* to a depth of 24 feet 6 inches, and, crosscutting the ledge at that depth, found it 3 feet wider than on the surface, and from appearances it is practically vertical. Cross-channel samples have been submitted to the Department of Mines for assay, but owing to the owners having worked until Christmas, when the samples were taken, no returns have as yet been received. At about 12 feet they appear to have run through the oxidation, and it should now be simple to determine whether the showing is such as will warrant the belief that they have the making of a mine.

In conclusion, it appears to me that to have a stabilizing effect on the gold-mining industry and economic conditions throughout the district other methods of mining than the short season of hydraulicking must be introduced, and, from what I can gather, there should be a great future for dredging on a great many of the streams, as it is possible to work a dredge with a very limited quantity of water the year round, and with the introduction of dredges and development of the quartz properties the output from the Cariboo should rival the old golden days.

The office statistics show the revenue collected to be about the same as last year, which, considering it was the fourth year of the war, appears to me to be most satisfactory, as, owing to the greatly increased cost of mining with gold at its standard value, operations were reduced to a minimum. I shall be greatly disappointed if from now on the revenue does not largely increase and gold-mining become very active again.

OFFICE STATISTICS—CARIBOO MINING DIVISION.

Free miners' certificates issued (not including South Fort George)	141
Free miners' certificates (special)	3
Placer claims recorded	6
Placer claims rerecorded	27
Mineral claims recorded	119
Certificates of work issued	96
Placer-mining leases granted	20
Leaves of absence, placer, granted	15
Conveyances and other documents recorded	71

Revenue.

Free miners' certificates (including South Fort George)	$2,238 25
Mining receipts, general	6,076 60
Revenue from other sources	1,392 15
Total	$9,707 00

OMINECA MINING DIVISION.

REPORT BY STEPHEN H. HOSKINS, GOLD COMMISSIONER. (OFFICE AT HAZELTON.)

I have the honour to forward herewith office statistics for the Omineca Mining Division for the year 1918. It will undoubtedly be noted with satisfaction that the revenue derived from this source again shows a slight increase, being very close to $600 in excess of the amount received under the same subhead during the year 1917.

Mining throughout this Division became very quiet toward the end of the year, but a few of the properties throughout the district are still undergoing development, concerning which the District Resident Engineer will undoubtedly report upon *in extenso*.

It will be observed from the office statistics that placer-mining in this Division has received some attention, but I regret I am unable to report that the earlier stakings have undergone development.

Office Statistics—Omineca Mining Division.

Free miners' certificates issued (ordinary)	458
Free miners' certificates issued (company)	6
Free miners' certificates issued (special)	4
Mineral claims recorded and issued	300
Placer claims recorded and issued	4
Certificates of work	677
Bills of sale and other mining documents	113
Powers of attorney recorded	40
Mining documents filed	38
Certificates of improvements recorded and issued	31
Crown grants of mineral claims	31
Applications for placer-mining leases (Omineca Division, 17; Peace River Division, 33)	50
Placer-mining leases issued (Omineca Division, 12; Peace River Division, 33)	45
Placer-mining leases not granted (Omineca Division, 5)	5

Revenue.

Free miners' certificates	$ 3,861 00
Mining receipts, general	11,527 25
Total	$15,388 25

QUESNEL MINING DIVISION.

Report by R. M. McGusty, Acting Mining Recorder.

I have the honour to submit herewith my report on mining operations in the Quesnel Mining Division of the Cariboo District for the year ending December 31st, 1918.

The past season has been one of the least productive for a number of years. The main causes of lack of production may be attributed to the fact that this Mining Division is, so far, dependent almost entirely on the output of gold, and that no change takes place in the value of this standard metal, although the cost of production has steadily increased during the last few years, due to the increase of wages and the high cost of living; on the other hand, there have been very great increases in the values of other metals, through war-time demand for same, with a consequent increase in the price of wages, the net result being that many of the miners have left this district, attracted by the higher wages offered.

In the Quesnel Forks section a certain amount of prospecting has been done, but no development-work to any extent.

In the Keithley section the *Kitchener* mine (Harrison & Worth) has only been operating on a very small scale, gold to the value of about $1,400 being shipped.

The Quesnel Hydraulic Gold Mining Company is the only company in this district that has carried out development-work to any extent, employing a crew of about twenty men for the greater part of the season.

Both the *Kitchener* mine and the Quesnel Hydraulic Gold Mining properties were inspected by J. D. Galloway, Resident Engineer, during the past season, and I understand he is furnishing reports thereon to the Department.

In the Harpers Camp section the International Dredging Company, Limited, continued work during the earlier part of the season.

The Western Mines Exploration Syndicate, Limited, has during the past season been operating a drill and prospecting the properties with satisfactory results, and it is probable that active development-work will be commenced next season.

In the Lac la Hache section (Timothy mountain) Ryan & Hamilton have been busy during the past season exposing veins on their molybdenum properties.

During the past season there have been numerous inquiries as to tungsten properties.

OFFICE STATISTICS—QUESNEL MINING DIVISION.

Free miners' certificates (individual)	128
Free miners' certificates (company)	1
Placer claims recorded	1
Placer claims rerecorded	14
Mineral claims recorded	30
Certificates of work	18

EASTERN DISTRICT (No. 5).

Report by A. G. Langley, Resident Engineer.

INTRODUCTORY REMARKS.

This district includes the following Mining Divisions: Golden, Windermere, Fort Steele, Revelstoke, Lardeau, Ainsworth, Slocan, Slocan City, Trout Lake, Nelson, Arrow Lake, and Trail Creek, generally referred to as the East and West Kootenays. This is the oldest lode-mining district in British Columbia; in it there are as many mines being operated as in all the other districts put together, although some are only producing in a very small way. With the exception of a very small percentage, it is responsible for the entire lead and zinc production of Canada. In 1918 it produced 70 per cent. of the silver-output of the Province, about 33 per cent. of the total gold-output, and 28 per cent. of the coal.

The first metalliferous mine to be staked in the district was the *Blue Bell*, on the shore of Kootenay lake. It was located in 1865 and is being operated at the present time.

The Rossland mines, which are now being operated by the Consolidated Mining and Smelting Company, were located in 1890.

The *Slocan Star*, which was staked by Bruce White in 1891, is being operated by the Silversmith Mines, Limited.

The *Sullivan* mine, in the East Kootenay, which is being mined by the Consolidated Mining and Smelting Company, and promises to become one of the famous mines on the American continent, is of more recent date.

There are many other properties which were staked years ago that are still being operated, although some of them have been forced to close down from time to time on account of market conditions; but the fact remains that the total production for British Columbia of silver, lead, and zinc alone totals over $93,000,000 up to the end of 1917, and conditions look promising not only for the present production being maintained, but being increased during subsequent years.

Generally speaking, the production of all the above-mentioned metals compares favourably with that of last year, in spite of the industry being severely handicapped by lack of efficient labour and the high price of machinery and supplies.

The gold production of recent years has been principally derived from the Rossland camp, but it will not do to overlook the placer-deposits of the Kootenays, from which large quantities of gold have been recovered in the past, and which undoubtedly still have possibilities.

The discovery of placer gold on Wildhorse creek, near Fort Steele, first attracted mining men to the Kootenays in the early sixties. Since this time mining has been carried on to a limited extent.

Shortly after the Wildhorse Creek rush new discoveries were reported up in the "Big Bend" of the Columbia river, some fifty miles north of Revelstoke, where gold was found in the gravels of Carnes, Downey, McCulloch, Gold, French, and Smith creeks. There was great excitement over these diggings for a time, and, although quite a little gold was recovered, it was only from shallow diggings. Gold was known to exist on the bed-rock, and a good deal of money was spent in endeavouring to reach it, but boulders and much water prevented economical mining. The excitement subsided and the crowd left the district, leaving behind only a few men, whose tenacity and dogged perseverance have kept some of them there, even up to the present time.

Other placers which were worked some years ago, and are again attracting attention, are located on Perry creek, which is a tributary of St. Mary river, in Fort Steele section.

Oil-seepages have been found in the Flathead section, and according to Ralph Arnold's report, which is published in the Annual Report of the Minister of Mines for 1915, the possibilities of finding oil in commercial quantities are favourable.

Good transportation facilities are provided throughout the district by the Canadian Pacific Railway Company, and the mining centres can be comfortably reached by boat or train, while to the majority of the prospects there are good trails over which it is possible to travel on horseback.

The Consolidated Mining and Smelting Company's smelter at Trail, which is conveniently situated to the mining centres, accepts silver-lead, copper, and gold ores for treatment.

Nature has not only endowed this section of British Columbia with great mineral wealth, but also with fine timber, rivers, and streams, so that there are few places indeed where fuel and water-power are not available for mining purposes; while the grandeur of the scenery and the excellent climatic conditions tend to make mining a more pleasant occupation than in the dry arid regions and semi-tropical climates of the south, or, in the intense cold of the far north. During the season the writer's time was taken up in visiting prospects and attending to claims for Government assistance under the "Mines Development Act" for roads and trails to mining properties.

Proposed trips to some of the leading mines during the latter part of the year were postponed on account of the influenza epidemic, which was very bad throughout the country, and led to some of the camps and many of the mines being placed under quarantine.

The duties of the Resident Engineers are to advise and assist the small operator and prospector, with a view of increasing the production, rather than to report on the mines operated by large companies, which are well able to take care of themselves.

FORT STEELE MINING DIVISION.

Sullivan. Located near Kimberly, in the Fort Steele Mining Division; owned and operated by the Consolidated Mining and Smelting Company, Limited. The property was staked in 1895. In 1902 the Sullivan Group Mining Company erected a small smelter at Marysville, which closed down in 1908. In 1910 the property was acquired by the Consolidated Mining and Smelting Company, and has since been extensively developed, and is now considered to be a great mine. For a long time the problem of treating the complex zinc ores prevented large tonnages high in metallic content from being considered of commercial value. In 1918 a satisfactory solution of this problem is said to have been obtained, and thus many millions of tons of ore previously considered to be of no commercial value was added to the already large reserves. According to the management, by mining and treating this ore on a large scale they will be able to produce zinc and lead at a profit on any market that existed in recent years, providing the price of labour and supplies drops with the prices of these metals. The long adit-tunnel, which now has a length of about 8,000 feet, is reported to have reached the ore-bearing zone.

The Kimberly section, in which the *Sullivan*, *North Star*, and *Stemwinder* are located, is underlain by the Aldridge formation. The deposits are replacement deposits in the argillaceous quartzites of the Aldridge formation. At the *Sullivan* the walls are not well defined and the ore gradually grades into the country-rock. The core of each ore-body is composed of fine-grained galena and zinc-blende, which gradually passes into an exterior of an intimate mixture of pyrite, pyrrhotite, and zinc-blende. This property is the largest producer of lead and zinc in the Province. During last year it produced 31,622 tons of lead ore, 98,532 tons of zinc ore, and 4,334 tons of iron pyrites.

Stemwinder.—This mine, situated on Mark creek, was bonded by the Federal Mining and Smelting Company, who did two or three months' diamond-drill work, but the results were evidently not satisfactory, as the project was abandoned.

North Star.—This property has been worked under lease by O. Brander and O. C. Thompson during the latter part of the year; about 2,500 tons of ore has been shipped to Trail. Indications are reported to be favourable for the continuance of shipments.

St. Eugene.—Situated at Moyie. This property has been worked by the Consolidated Mining and Smelting Company and by leasers. Shipments to Trail total 1,200 tons.

Victor.—Very little work has been done on this property during the year. It is reported that the company is being reorganized with a view of obtaining more capital to carry on progressive development-work.

Renewed activity has been in evidence at the placer-gold workings on Wildhorse and Perry creeks. On Perry creek a company has taken over the property owned and formerly operated by the Perry Creek Hydraulic Company. A considerable amount of work has been done in preparation for next season's operations.

Successful results were obtained from work done on a small scale on Wildhorse creek, where $600 is said to have been taken out of three sluice-boxes.

Yellow Metal Group.—Further prospecting-work has been carried on at this property by W. van Arsladen, of Cranbrook, who is one of the principal owners. It is a gold-quartz property.

WINDERMERE MINING DIVISION.

Paradise.—This property, which is owned by Robert Randolph Bruce, of Invermere, has been operated steadily during the year and has shipped 2,768 tons to Trail, which is an increase over last year's shipment of 400 tons. Thirty-five to forty men are employed at the mine.

Silver Belt.—Situated in Spring Creek basin, below the *Paradise;* owned by C. M. Keep, of Kendrich, Idaho. During the year a shipment of 31 tons was made to Trail. The ore is somewhat similar to that at the *Paradise.*

Lead Queen.—Situated on Frances creek. Tom Brown, of Athalmer, is the principal owner. The property is reported to have been bonded this year to Paul Denhart, of Seattle, who has a small crew working at the property. Shipments will probably be made this winter. Between 70 and 80 tons of ore was sacked last winter, but unfortunately a bridge was carried away, which prevented shipments being made. The ore carries about 30 or 40 oz. in silver and about 65 per cent. lead.

Tatler Group.—R. S. Gallop has been doing some development-work on this property. The group, consisting of twelve claims, is situated at the head of the South fork of Horse Thief creek. The metallic contents of the ore are principally copper.

Hot Punch.—On the North fork of Toby creek. It is reported that a car-load of ore was hauled from this property during the season.

Boulder Creek.

Trojan Group. This property, consisting of a group of six claims, was acquired early in 1918 by F. W. Wonn, of Seattle, who formed a company called the Trojan Copper Mine Corporation, and development was started on the property under the supervision of E. D. Smith. The property is situated at a distance of about eighteen miles from Athalmer, which is the nearest point on the railway. Five miles of road was built this year up Boulder creek, and three miles of 4-foot trail from the end of the road to the *Trojan* camp. The elevation of the camp is 4,600 feet, and is easy accessible, being located on the grade of the new trail. Since acquiring the property the company has built a two-story log cabin, which is used as a cook and store house, 18 x 26 feet, and a bunk-house 20 x 34 feet.

The ore occurs in a broken quartz vein which outcrops along the bank and about 100 feet above Boulder creek. The country-rock, consisting of talcose schists and slates, is greatly folded and contorted in the immediate vicinity, and until further development-work is done it is impossible to arrive at any definite conclusion as to the probable continuity of the ore with depth or along the strike of the vein.

The principal ore-mineral is chalcopyrite, which on the surface has been partly oxidized to carbonates of copper; the associated minerals are tetrahedrite and iron pyrites; the gangue is highly siliceous. A sample of the sorted ore for shipment ran: Gold, trace; silver, trace; copper, 15.5 per cent. At the time of examination there were between two and three car-loads of high-grade ore available for shipment, and since then further development is reported to have disclosed a considerable tonnage. The manager reports that he intends to haul ore this winter, and to install a 9 x 8 Ingersoll-Rand compressor and 30-horse-power Diesel type engine.

The development-work consisted of 116 feet of tunnelling and three open-cuts along the strike of the vein. Seven men were employed.

Sitting Bull. Conditions at this property have not changed to any appreciable extent since last year. Some 300 sacks of high-grade ore was extracted from the upper tunnel, in which there is reported to be a good showing of ore. This tunnel cannot be worked during the winter on account of snowslides, and at the time of my visit on June 29th it was hidden somewhere under 15 or 20 feet of snow. The old shaft, from which 7 tons of high-grade silver-lead ore was sacked last fall, was full of water and ice. A sample of the sacked ore from this shaft ran: Gold, 0.01 oz.; silver, 116.2 oz.; lead, 19 per cent.; zinc, 3 per cent. Last winter a snowslide carried away part of the cabin, which has been abandoned and a small one erected near by.

The erection of a light tramway was started last autumn, and a cable consisting of four No. 9 wires twisted together was taken up the mountain and fixed on light towers; which was

no small task, as the distance spanned is 2,100 feet, and the mountain-side is rugged and precipitous.

As it was not found practical to carry on mining operations at the upper workings during the winter months, the company proposes to run an adit tunnel at a location easily accessible and free from snowslides, to tap the vein at a point vertically below the old shaft. To facilitate this work the installation of a compressor is contemplated.

Black Prince Group.

This property is located on the south side of Boulder creek, within half a mile of the *Trojan* cabins. The development-work which was done some years ago, according to old reports, consists of a 15-foot drift on the vein and a 90-foot crosscut. These workings were caved in, and hence could not be examined. Only a few tons of ore was in evidence on the old dumps. A sample from a small lot of sorted ore ran: Silver, 1.4 oz.; copper, 14.2 per cent. M. E. Olson is reported to have bonded the property and to have started some men to work. For further reference *see* Annual Report of the Minister of Mines for 1915.

From this property a good trail which leads over the divide to the *Paradise* mine was followed for a distance of about three miles up to the summit. Near this trail, on the Boulder Creek slope of the Paradise mountain and in a northerly direction from the mine, a narrow belt of limestone forms a ridge of low but rugged crags above the surface of the surrounding country, which is covered to a considerable depth with broken fragments and splinters of slate. In places near the contact of the limestone there is evidence of ledge material composed of broken fragments of quartz and limestone heavily stained with oxide of iron. Claims have been staked on this ground and some prospecting done with the expectancy, no doubt, of finding silver and lead values in the form of oxides and carbonates. According to reports, no satisfactory values have yet been obtained.

Surface conditions in this area are somewhat similar to those at the *Paradise;* hence I would consider it worthy of further attention from the prospector. The limestone ridge terminates in a bluff near Boulder creek, near the foot of which E. D. Smith has staked some claims on a quartz vein near the contact of the limestone and schist, and from which he claims to have got fair values in silver and copper. No work has been done on these claims yet.

Burman Group.

This group, comprising the *Bald Eagle*, *Blue Grouse*, and *Mayflower* mineral claims, is situated on the Boulder Creek slope of the Paradise mountain, and at a distance of about a mile and a half in a north-westerly direction from the *Paradise* mine. J. Burman started work on this property in the fall of 1917, and in a few months accomplished a lot of work single-handed including the building of a small cabin, blasting out a short length of trail around the bluff, 100 feet of tunnelling, and sinking a 7-foot winze. At the time of visiting the property he was busily engaged driving a crosscut in the slide material at the foot of the bluff, with the object of tapping the vein at a vertical depth of about 200 feet below the tunnel.

The tunnel follows the vein for a distance of 55 feet, where there is a lenticular shoot having a maximum width at the roof of the drift of 8 inches, which widens to 12 inches in the bottom, and is said to increase to 20 inches at the bottom of a 7-foot winze, which, however, was full of water. Beyond the winze the tunnel has been continued for 40 feet, but no ore was encountered, and the face was in schist.

The apparent strike of the vein is N. 60° W. and dip 47 degrees to the north-east. A sample taken across a width of 12 inches at the top of the winze ran: Silver, 52 oz.; lead, 20 per cent.; zinc, 12 per cent. Exceptionally high silver values have been obtained from a few picked samples.

The formation, consisting of limestone, quartzite, and schist, is somewhat complex, and the possibilities of the property can best be ascertained by further development-work.

GOLDEN MINING DIVISION.

Couverapee.

This property is situated above the *Monarch* mine, near Field, and is now being operated by the Couverapee Mines, Limited, of Calgary. S. Chapin is general manager; W. Orville Young, mine superintendent; and W. Whittaker, mine foreman. The ore occurs as a bedded vein replacing the limestone in large shoots. A considerable quantity of ore is said to be available for extraction, while the average values are reported to be: Lead, 15 per cent.; silver, 3 oz.; and a small percentage of zinc. The ore is concentrated

in the Monarch mill. During the year 776 tons of ore has been shipped to Trail, which is a considerable increase over last year's shipments.

Tarheel Group.

It is reported that C. J. Lincke has been doing a little work on the *Rainbow* claim. A small cabin was built near the tunnel-site, and another at Spruce Tree camp, on the Middle fork of the Spillimacheen river. The trail from Carbonates Landing to Spruce Tree camp is reported to be in good condition. This trail also gives access to the *Bobbie Burns* and *International* groups, which are situated near the headwaters of the Middle fork of the Spillimacheen. No work has been done on these properties for a number of years, but they are now evidently attracting attention, as several parties have made examinations during the season.

Among other properties in which some interest has been taken during the season are the *Atlanta*, *Constance*, and *Horseshoe* claims, on Jubilee mountain, near Spillimacheen. H. Moody, of Golden, had the old trail slashed out and the claims surveyed. The ore is said to run high in copper values.

I.X.L. and Condor.

These claims are owned by R. McKeeman and W. Logan, of Casteldale, and are situated at an elevation of 1,600 feet above the Columbia river. In order to reach the property the river is crossed at a point near Castledale, and then a trail is followed for a distance of about five miles. With the exception of a short steep grade to the top of the first bench above the river, the trail is of an easy grade, and the trip from Castledale and return can be comfortably made in a day. The claims are located along and near the top of a small isolated ridge which rises abruptly to a height of 600 feet above the surrounding country, and from the top of which an excellent view can be obtained of the Columbia and Spilllimacheen valleys. The country which forms the divide between these two large watercourses is not of a rugged nature, and is characterized by rounded knolls and ridges, the gentle slopes of which are thickly wooded with small timber and underbrush, while a few small lakes can be seen lying in the depressions.

The formation consists of beds of argillites and limestone, dipping almost vertically and having a south-easterly strike. The ore, consisting of an intimate mixture of galena and sphalerite, carries low silver values and occurs replacing and impregnating the limestone near the contact with the argillites. In places the ore occurs in bunches and streaks, and in others it appears to be disseminated through the limestone. Where the limestone has been crushed and shattered by pressure the percentage of ore is greater than elsewhere. The workings consist of a shallow shaft sunk to a depth of about 10 feet near the top of the hill. A sample across 5 feet of soft ledge-matter at the bottom of this shaft gave 2.7 oz. silver and 7.8 per cent. lead. On the hillside, immediately below the shaft, galena and some lead carbonates are exposed in a shallow open-cut. A sample of the former gave 8 oz. silver, 10.2 per cent. lead, and 24.5 per cent. zinc; a sample of the carbonates gave 4 oz. silver, 27.5 per cent. lead, and 20 per cent. zinc.

Following around the contour of the hill for about 750 feet, a small open-cut exposes a face of low-grade ore, a sample of which ran 7.6 per cent. lead and 4.5 per cent. zinc. This can be traced up the hill for a considerable distance. Not much importance can be attached to the shallow surface diggings, which at the time of my visit did neither prove the lateral nor longitudinal extent of the ore-body, but the mineralized area apparently covers the wide zone along the contact of the argillites and limestone, and there is a possibility of developing a considerable tonnage of low-grade ore.

Unfortunately there is no water available for mill or power purposes in the immediate vicinity, although a desirable site could probably be located near the Columbia or Spillimacheen rivers. In a direct line the property is only about a mile and a half from the Columbia, and it is possible that a good outlet can be obtained by a short road across the top of the ridge and then by aerial tram down to the river. However, these are matters which can be carefully gone into should the development of the property be under serious consideration. The value of the property depends on the development of sufficient ore of a desirable grade to justify the erection of a concentrator and to enable mining operations to be carried out on a large and economical scale.

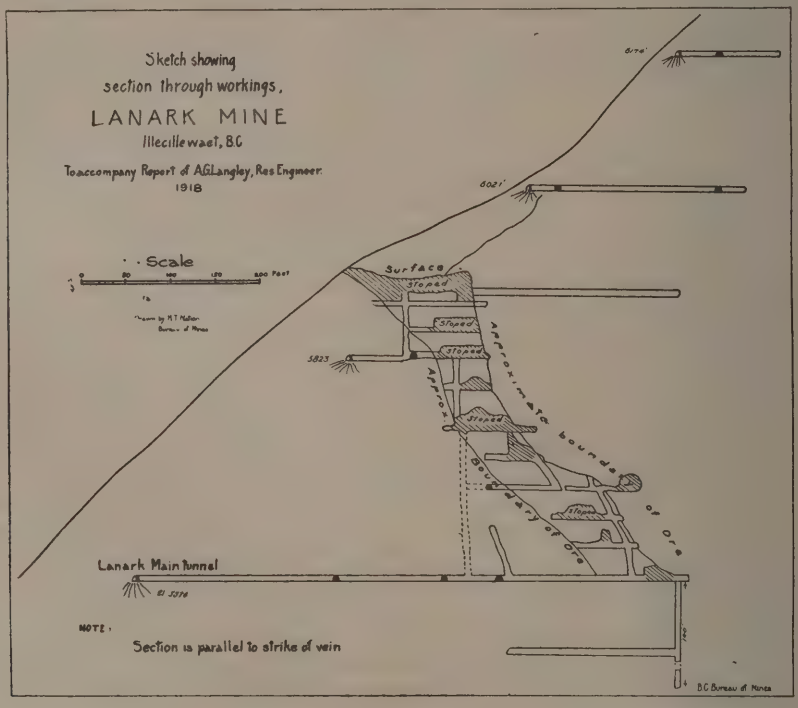
REVELSTOKE MINING DIVISION.

Lanark.

The lower camp, consisting of commodious buildings erected by the previous company which operated the property in 1896, is situated near Laurie Station, on the main line of the Canadian Pacific Railway. The mine camp is situated

on the steep side-hill near the entrance to the main tunnel, and at an elevation of 2,600 feet above the railway. The buildings, which afford good accommodation for a fairly large crew of men, are very substantially built.

The main tunnel or 400-foot level is about 700 feet long, and from this tunnel a large shoot of ore has been stoped to the surface. According to old reports, the width of the ore near the surface was between 20 and 25 feet, which decreases to 4 or 5 feet in the lower workings. From the lower tunnel a shaft has been sunk to a depth of 140 feet, and from which some 180 feet of drifting is reported to have been done. There is said to be a good showing of ore in these



workings. Unfortunately, at the time of examination the shaft was inaccessible on account of water. The deposit occurs in a bedded fissure-vein, which has a dip of 50 degrees to the north-east, and a strike of N. 46° W. The hanging-wall is slate and the foot-wall carbonaceous limestone.

At the present time ore is being extracted from the upper portion of the *Lanark* shoot and from a point higher up the hill, on the *Maple Leaf* claim, but not a great deal of importance can be attached to these workings at present; the future of the property apparently depends greatly on the success obtained in the shaft, and on the development of a promising showing recently discovered higher up the hill, where a quartz vein can be traced for some 200 feet. Good-grade ore shows in lenses at intervals along the outcrop. The walls of this vein are slate. An assay of sorted ore from this showing ran as follows: Gold, trace; silver, 35 oz.; copper, 3.4 per cent.; lead, 51 per cent.; zinc, 12.4 per cent.

In order to carry out his scheme of development, W. Dornberg, the manager, decided that it would be necessary to install a power plant to run the mine compressor, pumps, and a small hoist for the shaft. The installation of this plant was commenced early in the year and was completed in the fall. The plant consists of a Baden-Globe turbine; a C.G.E. alternating-current generator, the full load of which is 2,300 volts 39.7 amperes at a speed of 300 revolutions; an exciter for generator; and a Woodward governor to regulate the speed of the turbine. The water-power is derived from the Illicillewaet river, and is conveyed by a square flume 4 x 4 feet and 700 feet long. The head of water at the turbine is about 25 feet. The power developed will also be used to run the concentrator, which was originally driven by a steam plant.

The concentrating equipment of the mill consists of two double 4-compartment jigs, one single compartment fine jig, one bull-jig, and one Deister-Overstrom table. Connecting the mill with the mine there are two independent 2-bucket trams—the lower one operating from the mill to a central station at the top of an intervening ridge, and the other from this station to the mine. The lower span is 3,400 feet long and the upper 3,600 feet.

Woolsey Group.

This property, consisting of seven claims—the *Alice*, *Helena*, *Nellie E.*, *Bee*, *May*, *Cora*, and *Joy*—is situated on the East fork of Silver creek, which flows into the Illecillewaet river at a point about two miles west of Albert Canyon Station, on the main line of the Canadian Pacific Railway. The elevation of the camp is 4,200 feet above sea-level, or 2,000 feet above Albert Canyon, from which place a good trail leads to the property, the distance being seven miles. The original group consisted of four claims, which were staked by P. E. Kennedy; the other claims were staked this year.

David Woolsey took a lease and bond on the property in 1917, and built a new trail, which was completed in the early part of 1918. Before this time it was difficult to reach the claims, as there was practically no trail, and in places the hillsides are steep and covered with dense underbrush.

New cabins were built at a convenient distance from the workings this fall. The work which is now being carried on by D. Woolsey consists of driving a tunnel in the foot-wall and in the direction of the strike of the vein. Crosscuts to the vein will be driven at intervals. There is plenty of timber for mining purposes, while a good mill-site is available on Silver creek.

A trip was taken to the property early in July to ascertain whether assistance towards building the trail was justified under the "Mines Development Act," and a cursory examination was made.

The vein, which is composed of massive white quartz, outcrops on the hillside at an elevation of about 1,000 feet above the creek, where an open-cut and a 10-foot tunnel expose a width of about 15 feet, in which is included narrow bands of slate. Farther up the hill clean galena ore is exposed at the surface, but very little work had been done on the vein at the time of examination. The vein, which also can be readily seen cutting the hillside on the opposite side of the creek, has a dip of 40 degrees to the north-east and a strike of N. 42° W. The strike and dip conform to that of the strata; hence it may be classified as a bedded fissure-vein. The formation is composed of a dark carbonaceous slate, probably belonging to the Carboniferous period and correlated to the similar rocks of the Lardeau and Trout Lake Divisions. The strata are not badly folded or faulted, and the vein shows persistency in outcrop.

The principal ore-mineral is argentiferous galena, which occurs replacing the quartz in streaks and bunches. The associated minerals are zinc-blende and iron pyrites, which do not appear to be intimately mixed with the galena; hence the ore is amenable to concentration. A sample of sorted ore for shipment ran: Silver, 80 oz.; lead, 25 per cent.; zinc, 4 per cent.

Although some high-grade ore could be mined for shipment, in order to operate the property to the best advantage the installation of a concentrator would ultimately be necessary when sufficient ore has been developed to justify it. At the present time it is a promising-looking prospect, but the continuity of the ore in commercial quantities has yet to be proven by further development-work.

Other claims have been staked above the *Woolsey* group, and on the same lead, by Gus. Hedstrom and O. Sandberg, of Albert Canyon. There is reported to be a good surface showing on these properties, but the writer has not had an opportunity to examine them yet. It was while examining these properties that A. B. Clabon, president of the Vancouver Chamber of Mines, missed his footing, fell over the edge of a bluff, and lost his life.

Mastodon.

The season's work has been principally confined to prospecting the lead on the Carnes Creek slope, where the vein is said to be exposed in the face of a bluff. During the winter months the shaft was sunk to a total depth of about 129 feet. About 20 tons of ore was hauled to the end of the Big Bend road, but unfortunately a heavy mud-slide late in the fall prevented the shipment from being hauled to the railway.

E. McBean, an old-time miner and prospector in the Big Bend district, has been engaged in the development of his property on Carnes creek and in doing further prospecting-work during the year.

Placer-mining is carried on every year on a small scale on the creeks entering the Columbia river, north of Revelstoke, but no information is to hand regarding the results obtained.

TROUT LAKE AND LARDEAU MINING DIVISIONS.

Mining activities have been on a smaller scale than last year in these Divisions, and it is to be hoped that before long the district will attract the attention that it deserves.

Triune.—R. H. Batty resumed work this year, and employed fourteen men during the summer.

Towser.—This property was worked under lease and bond. Eight to ten men were employed.

Nettie L.—Peter Cameron and others had a lease on the property. Five men were working during the season.

Ethel.—A few men were working on this property, and a small shipment was made to Trail.

True Fissure.—Development-work was done under the management of A. C. Houston. Ten men were employed.

Fidelity.—This property, which is situated near Gerrard, was worked during the season by J. C. Rady.

The following is a list of shipments made to Trail: *Towser*, 81 tons; *Triune*, 46 tons; *True Fissure*, 41 tons; *Ethel*, 13 tons; *Nettie L.*, 31 tons; *Foggy Day*, 9 tons; *Fidelity*, 6 tons.

TROUT LAKE MINING DIVISION.

A somewhat hurried trip was taken with Mrs. Jowett, of Trout Lake, to examine some of her prospects and to gain at least an idea of the geology and topography of that part of the country along the southerly slope of the Silver Cup mountain, in which so many claims have been staked, and all of which, with the exception of a few, are now lying idle; the cabins are becoming dilapidated and the workings caving in. Many of the properties in this district are described by Newton W. Emmens in the Annual Report of the Minister of Mines for 1914; reference is also made to them in Annual Report of 1903 and in the Geological Survey Report for 1903.

Generally speaking, the principal values found on the south-westerly slope of Silver Cup mountain are in gold, which occurs in quartz veins, either cutting or following the bedding-planes of the formation. Greenish-grey and brown schists shot with quartz stringers and veinlets are characteristic of the formation in this particular section. Two quartzite dykes which run along the summit of the mountain and having a north-westerly strike, can easily be traced for a considerable distance and form an approximate boundary between the silver-lead properties on the northerly slope and the gold properties on the southerly slope. The formation on the northerly slope consists of carbonaceous shales, slates, and limestones, in which are located the *Cromwell*, *Triune*, *Silver Cup*, *Nettie L.*, and other properties. The country is easy of access by good trails either from Trout Lake or Ferguson, which connect with the summit trail, and from which nearly all the properties are within easy reach.

U & I. Taking horses at Trout Lake, an excellent trail was followed along the north-east shore and up Six-mile creek to the summit of Silver Cup mountain to this property, which is owned by Mrs. Jowett, and consists of two claims—the *U & I* and *Hercules*. The formation consists of greenish-grey schists, in which occur numerous quartz inclusions as stringers and gash-veins, having a general tendency to follow the schistosity of the country-rock. Some open-cut work and shallow shaft-sinking has been done on some quartz-showings. A sample from a small pile of sorted ore from a 30-foot shaft ran: Gold, 1.8 oz.; silver, 9 oz. The vein, which is 1 foot wide at this point, has a strike of N. 10° W. and has a dip of 38 degrees to the east. It is a prospect in the initial stage of development, on which further prospecting-work is necessary to prove its value.

Okanagan. This property adjoins the *U & I* higher up the hillside, and is fully described in the Annual Report for 1914, since which time no further work has been done. A quartz vein, which is strong and well defined, cuts the formation, consisting of argillites and schist, and can be traced for a considerable distance on the surface. The strike is N. 25° E. and dip almost vertical. The width of vein exposed at a small open-cut and shaft is 45 inches. The crosscut tunnel driven to tap the vein below the open-cut evidently did not reach its objective, as there is no evidence of vein-matter on the dump. An average sample taken across the vein at the shaft by Newton Emmens, whose report may be seen in the Annual Report of the Minister of Mines for 1914, ran: Gold, 1.9 oz.; silver, 2.9 oz. It would appear to be a prospect upon which further work is justified.

Foggy Day. This property, comprising two claims—the *Foggy Day* and *Bronze*—it situated at the headwaters of Eight-mile creek at an elevation of about 7,300 feet. The property, which belongs to Mrs. Jowett, was being worked by J. Lamphere under a lease and bond. A quartz vein is exposed in the side of a precipitous bluff by a series of open-cuts, while a certain amount of gophering has been done to win the ore, but no systematic development-work has as yet been attempted. The vein varies in width and is irregular in strike and dip. The formation, which is composed of grey talcose schist, is crushed and decomposed in the vicinity of the vein. Good gold values have been found along the foot and hanging walls. The gold-bearing quartz is honeycombed and stained with oxide of iron. A shipment made in 1917 gave the following values: Gold, 4.35 oz.; silver, 13.9 oz.; lead, 4.6 per cent.

On account of the heavy packing charges down Eight-mile creek to the lake, ore for shipment is carefully sorted and screened. There is a requisite amount of water near by for a small mill, and the property is undoubtedly one which has merit and on which further development-work might be done to advantage.

Crescent. This property is being developed by the Mansfield Mining Company, of Mansfield, Wash. M. Leahy, who is in charge of the work, has two or three men working. It is situated at an elevation of about 7,000 feet and at a short distance from the *Foggy Day*. A few open-cuts and an 18-foot shaft expose a small quartz vein cutting a brownish schist formation. At the bottom of the shaft, where the vein shows a width of about 1 foot, there is a small showing of galena which carries fair silver values, while from a narrow streak of soft decomposed iron-stained material good gold values have been obtained. A crosscut which was being driven to tap the vein at a point below the shaft is now reported to have reached its objective, and the vein is being developed at a vertical distance of 75 feet below the surface. The cabin is conveniently situated to the workings and has accommodation for four to six men, while there is plenty of timber available for mining and fuel purposes.

The *I.X.L.* and *No. 3* are situated in the same basin as the *Crescent* and have had a considerable amount of work done on them, but have been lying idle for some time and the workings have partly caved in, but no doubt could be cleaned out again at small expense. Reference is made to these properties on page 125 of the Annual Report for 1903. Farther on the *Arrallu*, belonging to Mrs. Jowett, was visited, but unfortunately the lower tunnel had caved and there was nothing of importance to report on.

Mrs. Jowett, who has lived at Trout Lake for the last twenty years or so, is one of the few lady prospectors in the Kootenays. Every year she goes out into the hills with her prospecting-pick, looking for mineral or directing work on her properties, and probably has as good a knowledge of the district as any one.

Trout Lake is one of the most beautifully situated settlements in the Kootenays, and any one desiring information regarding the natural resources of the country, or even a holiday, would do well to stay a few days at this place, and enjoy some excellent trout-fishing. Should trips be contemplated into the mountains, good horses and mules may be obtained locally or from Andy Daney at Ferguson, who has packed and hauled ore out of these hills for many years, and has a reputation as a packer.

LARDEAU MINING DIVISION.

Dunvegan Group. This group is situated on Bain creek near the headwaters of the Incomapleux river. Access is gained to the property by a good trail, which leaves the Canadian Pacific Railway at Flat creek and traverses the summit of the divide between the headwaters of this creek and the Incomapleux river. The distance to the property from the railway is ten miles. The elevation of the camp, which consists of one small cabin, is 3,750 feet. The vein, which has a strike of approximately N. 5° W. and dips at an angle of 50 degrees to the east, has been exploited by two adit-tunnels driven in the steep hillside at a vertical distance of 110 feet apart. At the uppermost or No. 1 tunnel, from which some ore was extracted many years ago, there still remains a small pocket of galena and zinc-blende which could not be considered of any commercial importance. A sample from a small pile of carefully sorted ore from this tunnel ran: Silver, 73 oz.; lead, 65.2 per cent.; zinc, 7.2 per cent. At the lower tunnel the vein has been drifted on for about 200 feet, but no ore is exposed. More recent work consisted of running a drift for 51 feet at a vertical distance of only 15 feet above the lower tunnel. No ore was developed. Other drifts farther down the

hill, and which are now caved in, evidently did not prove the existence of ore in any quantity. The vein, which has been formed along a fault-fissure, shows persistency along the strike, but the ore apparently only occurs at intervals in pockets and small bunches. The formation consists of calcareous shale and slate and is somewhat blocky in character.

R. A. Grimes, who had charge of the recent work on behalf of the Dunvegan Mining Company, ceased work this year, as he realized that in order to win more ore a certain amount of dead-work was necessary, which would involve a considerable expenditure and a proportionate amount of risk, while the inaccessibility of the property to transportation facilities is unfortunately a decided drawback.

Kitsap. This claim is situated at an elevation of 6,900 feet near the head of Lexington creek and at a distance of about twelve miles from Cambourne. The property is owned by Mrs. M. K. Stuart, of Wisconsin. A good cabin was built and a short length of trail was completed this year, but no work was done on the claim. The *Kitsap* and a number of other claims were staked many years ago along the strike of a strong and well-defined iron-stained vein which occurs along or near the contact of a blue limestone and schist. This vein can be traced for thousands of feet on the surface, but numerous open-cuts and shallow workings on the outcrop fail to expose ore of any consequence, and at only a few places is any galena noticeable.

At the *Kitsap* a cut 10 feet deep and 15 feet long shows the width of mineralization to be about 13 feet. The ledge is highly mineralized with iron pyrites, but galena only occurs in occasional blossoms. The gangue is silicified limestone. So far no ore has been developed which might be considered of commercial importance. A sample from a few tons of sorted ore ran: Gold, trace; silver, 5.4 oz.; lead, 40 per cent.; zinc, 1.2 per cent. More exploratory work along the outcrop will probably be done during the coming year.

Multiplex Group.—Development-work was continued during the early part of the year, but the property is now temporarily closed down, pending the securing of more capital.

There have been a number of inquiries about the *Mammoth*, *Scout*, and other properties, which seem to have attracted outside attention; but so far no new developments have taken place, and the Lardeau has suffered from an unusually quiet season.

ARROW LAKE MINING DIVISION.

There has been quite a little activity in the district surrounding Lightning peak, where rich discoveries of high-grade silver ore have been reported. Unfortunately the writer was unable to visit this part of the country on account of other work on hand. However, P. B. Freeland, Resident Engineer for the Southern Mineral Survey District, examined some of the properties in 1917, whose report may be seen in the Annual Report of the Minister of Mines for that year. The properties are situated at a distance of between thirty-six and forty miles from Edgewood, from which place horses may be obtained.

Millie Mack.—The trail has been extended from Blue Grouse creek for a distance of two miles to connect with the terminal of a light tramway recently constructed by H. E. Forster, the owner of the property. A small crew of men is employed at the property. Some 35 tons of sacked high-grade silver-lead ore is now ready for shipment at the mine.

AINSWORTH SECTION.

Florence. This property, consisting of eight Crown-granted claims, is owned by the Florence Silver Mining Company, of which F. R. Wolfle is manager and F. Hewer mine superintendent. The mine is developed by means of over 10,000 feet of underground workings. The concentrator, which is situated on the shore of Kootenay lake, is said to have a capacity of 150 tons. Water-power to run the plant is developed on Woodberry creek under a 350-foot head. A large gang of men was employed by the company during the year, and over 2,000 tons of silver-lead-zinc concentrates was shipped to the Trail smelter. The company declared its first dividend of 1½ cents a share, payable on March 20th.

No. 1.—Mining and development work have been actively carried on during the year by the Consolidated Mining and Smelting Company. John Cannon is mine foreman. The ore shipped this year, amounting to over 6,000 tons, shows a considerable increase in production over that of last year.

Highland.—This property is also operated by the Consolidated Mining and Smelting Company. L. W. Oughtred has been in charge of the work. During the year about 800 tons of silver-lead-zinc ore and concentrates has been shipped to the smelter.

Spokane-Trinket.—This property, which is owned by Frank T. McCullough and others, of Spokane, has been operated during the summer under the management of J. McGougall. Shipments for the year total 221 tons.

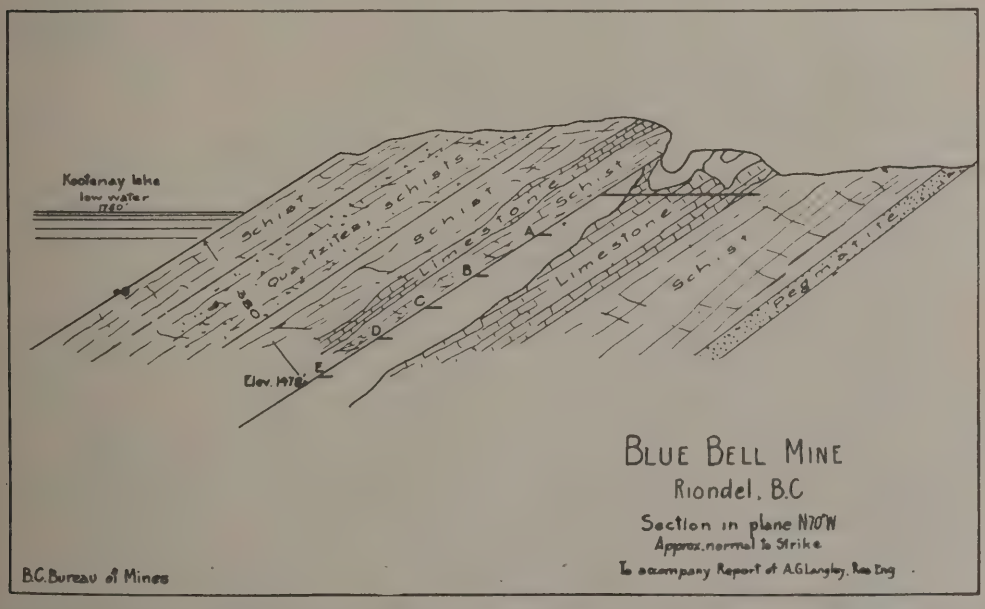
Other properties which have shipped during the year are as follows: *Little Phil*, 110 tons; *Tariff*, 26 tons; *Tam O'Shanter*, 38 tons; *Silver Hoard*, 37 tons; *Maestro*, 66 tons; *Gallagher*, 56 tons.

Development-work has been done during the year on the *Crescent*, at Coffee creek, and the *Buckeye*, where considerable work has been done under the supervision of Mr. Dagleish.

Molybdenite was reported to have been discovered near Crawford bay. Two men have put in a season's work on the property. No information is to hand regarding results obtained.

Fourth of July. This property, consisting of three claims, is held under lease and bond by John Cannon, of Ainsworth, and is situated at a distance of three miles by trail up Coffee creek. No work has been done on the claims for a number of years. Preparatory to the continuance of the development-work the building of a cabin was started last year, but was not completed at the time of examination. The ore-body may be described as a replacement deposit near the contact of schist and limestone; the ore replacing the latter consists of oxides and carbonates of lead and zinc, with occasional nodules of galena, in a soft, decomposed, and oxidized gangue. As may be expected in this class of deposit, the ore is irregular in occurrence, and nowhere is there evidence of a well-defined vein or boundaries. A sample across a width of 4 feet of this brown oxidized material at the bottom of the winze ran: Gold, 0.02 oz.; silver, 10.8 oz.; lead, 3 per cent.; zinc, 24 per cent.; while a grab-sample of about a 15-ton pile of the same material ran: Gold, 0.02 oz.; silver, 13.2 oz.; lead, 6 per cent.; zinc, 32 per cent. Better values are said to have been obtained by the owners. The principal workings consist of 242 feet of tunnelling and crosscutting, near the end of which a considerable amount of gophering has been done and some 50 tons of ore extracted.

Blue Bell. This well-known property is owned and operated by the New Canadian Metal Company, which is financed by French capital. S. S. Fowler has had charge of the mining and milling operations for a number of years. The mine is



situated at Riondel, which might well be considered one of the model mining camps of the Kootenays. The buildings and plant are well designed and laid out. Comfortable quarters are provided for the single men, while for those who are married, small cottages, each with its little

garden, can be had at a nominal rental from the company. The ore occurs as a replacement deposit in the limestone, the deposition having taken place along the lines of transverse fissuring. The limestone, which has a dip of 35 degrees and a strike of N. 70° W., lies between beds of schist. The mine has extensive underground workings which extend for a considerable distance below the level of the lake. The ore consists of galena, zinc-blende, and oxidized ores of lead and zinc. During the year over 5,000 tons of oxidized ore was shipped from surface workings.

This year difficulty was experienced in coping with the increased flow of water, and it was found necessary to install a new pump having a capacity of 1,000 gallons a minute. The pump, which is a Garratt jack-head plunger-pump, is stationed on the adit level and is driven by a Pelton wheel. The total length of the pump-rods will be 660 feet; the length of each rod is 30 feet and is made of 8- x 8-inch fir. The pump is now in operation and satisfactory results are being obtained. The concentrator has a capacity of 200 tons a day. The whole plant, including a Sullivan compressor and lighting generator, is driven by Pelton wheels, the water-power being piped for a distance of about three miles. Through the courtesy of Mr. Fowler a section of the formation is herewith shown.

The *Matchless*, *Exchange*, and *Speculator* group of claims is situated on Lockhart creek at a distance of six miles from Kootenay lake. The property is owned by T. Wall and R. Yuill. Very little work has been done on the property and no ore in commercial quantities has yet been developed. Galena in small quantities is found to occur in a series of small quartz veins, which show conformity to the limestone formation in which they occur. The best showings so far uncovered are near the contact of the limestone and schist. A sample of the ore ran as follows: Gold, 0.02 oz.; silver, 7 oz.; lead, 17.3 per cent.; zinc, 5.4 per cent.

KASLO SECTION.

Cork-Province. Mining and development work have been actively carried on during the year under the management of W. E. Zwicky. The production shows a substantial increase over that of last year. A Minerals Separation flotation plant consisting of fourteen 12 x 12 cells, three Wilfley tables, a Dorr classifier, and other equipment was added to the mill during the year. About 752 tons of silver-lead concentrates has been shipped to Trail during the year. Latterly the property has been temporarily closed down.

Index Group.—This property has been bonded by J. C. Roberts, of Portland, and others. A crosscut is being driven to intersect the vein at a point 500 feet below the old workings.

Utica.—This property has been operated by a crew of twelve men since July, during which time six cars of ore has been loaded for shipment.

Montezuma.—One hundred and six tons of zinc concentrates from the old dump was shipped, which had been neglected for fifteen years.

Silver Bell.—This property, situated on the South fork of Kaslo creek, is being operated by Green Bros. under the management of Mr. Newton. There is said to be a good showing of high-grade ore.

Whitewater.—This property has been worked under lease. The property is controlled by J. L. Retallack & Co., of which W. H. Burgess, of Kaslo, is manager. Large tonnages of ore have been shipped during the season, with very satisfactory results for both the leasers and the owners of the property.

Helen.—W. English, of Kaslo, has been doing some development-work on this property.

Bell.—Operated by the Jackson Basin Zinc Company. Shipments to Trail total 255 tons.

Lucky Jim.—The bulk of the shipments from this mine were made during the first six months in the year; for the balance of the year only small shipments were made. Total shipments to Trail, 1,843 tons.

Curle Manganese Group. This group, consisting of ten claims, which are located at a distance of seven miles from Kaslo, on the Kaslo & Nakusp Railway, is owned by A. J. Curle and A. G. Larson. Owing to the brisk demand and high prices prevailing for this class of ore during the war, this deposit attracted considerable attention and its development was watched with interest. The owners bonded the property to Colonel F. B. Millard, of Spokane, who erected small camp buildings and started a crew of about seventeen men to work at cleaning the surface and mining the ore. The ore chiefly consists of brown and black oxides of manganese, with occasional bunches of concre-

An Old-timer and Pioneer Prospector, Trout Lake.

Typical Prospector's Cabin, Ainsworth M.D.

tionary psilomelane. The ore occurs over two areas on a bench and adjoining gentle slopes of the hillside at an elevation of about 350 feet above the railway.

Without going into a detailed description of the deposit, it will suffice to say that the distribution of the ore, which forms a layer on the surface of the hillside, is uneven and irregular in occurrence, the thickness of the deposit varying from a few inches to 4 feet. During the latter part of June, 1918, when an examination of the property was made, the writer estimated that there was about 1,400 tons of ore positively in sight; beyond this any estimate of possible ore would at this time have been the wildest kind of a guess.

The primary deposit of manganese probably owed its origin to deep-seated springs arising from a body of intrusive magma. These waters deposited their burden of lime, iron, manganese, and silica in veins and veinlets of the country-rock. During subsequent erosion and oxidation the manganese has been collected by surface waters and redeposited on the benches and gentle slopes of the hillside. The iron, being precipitated first from the solution, forms the lower layer of the deposit, while the lime may have been an important factor in bringing about the precipitation on the manganese. The ore was easily mined by pick and shovel, but a certain amount of sorting was necessary to maintain a grade suitable for shipment. The first shipment contained such a high percentage of moisture that it was found necessary to install a dryer. The results evidently did not meet with much success, and after shipping fifteen cars the project was abandoned. The ore runs from 34.5 to 49 per cent. manganese, is low in silica and iron, and may be classified as a good grade of wad. It is possible that the failure to make a success of the venture may be attributed to unfamiliarity with mining and treatment methods for this class of ore.

Harp Group. This group consists of three claims—*Harp*, *Collingwood*, and *Black Diamond*—owned by W. J. Murphy, of Kaslo. The property is reached by a short trail which leaves the *Cork-Province* road at a distance of about five miles from Kaslo. Prospecting-work chiefly consists of a 33-foot drift along a quartz vein. The vein is 4 feet wide and occurs between a hanging-wall of compact dark argillites and a foot-wall of chloritic schist. The mineralization principally consists of rhodonite with which is associated small quantities of iron pyrites, pyrrhotite, and chalcopyrite. The rhodonite where exposed to the weather has been altered by oxidation from a silicate to an oxide of manganese. No values have been yet obtained which are of commercial importance.

Peterborough Group. This property consists of three claims—the *Ashnola*, *Peterborough*, and *Comstock*. J. Spiers and J. Moore, of Kaslo, are the owners. The elevation is about 4,200 feet. The claims are situated at a distance of seven miles from Kootenay lake on the southerly side of Campbell creek, which flows into the lake at a point almost opposite Kaslo. The formation belongs to the Shuswap series. The rocks are mostly grey gneisses, mica-schists, crystalline limestones, altered granites, and diorites. At a point where a small creek runs through the claims thin beds of shale and schist overlie a ledge of highly metamorphosed rock resembling gneiss, and which is highly mineralized with pyrrhotite, iron pyrites, and marcasite; a small sample of this material failed to give any gold values. This ledge is 10 to 15 feet thick, and being less easily eroded than the overlying rocks can be traced in a small bluff which it forms higher up the hill. The dip of the strata is 32 degrees to the west and the strike due north and south. In a small digging on this ledge at a point 300 feet above the creek, a sample was taken across 28 inches of oxidized material which gave 1.5 oz. in gold. The hillside is covered with overburden and the network of fallen burnt timber makes prospecting difficult. However, from the values obtained it is evident that it is a property well worthy of further exploitation, which probably could be done to best advantage by further surface work on the ledge. Ample water-power is available in Campbell creek for any possible mining or milling operations.

Leviathan Group. A hurried visit was paid to this property on the way down from the *Peterborough* group to the lake. Mining operations carried on by the Globe Mining Company in 1901 principally consisted of driving two crosscut tunnels into the contact between a mica-schist and granite. The upper tunnel is in 205 feet, and the lower, which terminates on an incline, is in 124 feet. The incline was full of water. Both tunnels are driven through an altered granite to the schist, and fair values in gold and copper were said to have been obtained, although there was no evidence of ore in the workings or on the dumps, and I am not aware of any shipment ever having been made. However, neither

the condition of the workings nor the time at my disposal allowed the making of a thorough examination.

Lincoln Group. J. H. and J. R. Thompson, of New Denver, worked this property during the season under lease and bond. The three claims comprising the group are located on the east side of Robb creek at a distance of two miles from Blaylock Station, on the Kaslo-Nakusp Railway. The workings are at an elevation of 4,900 feet. The ore, consisting of galena and lead carbonates, carries good silver values, is fairly free from zinc, and occurs in a crushed zone between a hanging-wall of limestone and a foot-wall of crushed slate. The gangue material is decomposed and heavily stained with oxide of iron.

On account of the formation being broken and faulted near the outcrop, the true strike and dip of the vein can only be determined by further development-work on the upper portion of the vein. A considerable amount of work was done in the past by crosscutting to strike the vein at a depth, which proved unsuccessful, and under the conditions was premature. The present work is being confined partly to surface exploration and partly to drifting along the vein at a short distance below the outcrop. Between 30 and 40 tons of clean galena and some carbonate ore was extracted during the summer, while the development-work is reported to have met with satisfactory results.

DUNCAN RIVER SECTION.

Lavina Butte.—Situated on Hamill creek. A few men have been working. Sixty-five tons of ore has been shipped.

St. Patrick Group.—Situated at a distance of six miles from Argenta. The property belongs to the British Alberta Mining Company, of which W. R. Allen, of Nelson, is secretary. A few men have been employed at the mine, and two car-loads of ore has been extracted for shipment.

International Group. This group, consisting of eight claims, is situated at a distance of nine miles north of Howser lake, on the Duncan river, making a total distance of about nineteen miles from Howser, which can be travelled by launch. The property is owned by the Blue Lake Consolidated Mining Company, of which W. J. Milne is manager. The mine-workings are located on the face of a bluff at an elevation of 5,200 feet above sea-level, or 3,100 feet above the Duncan river. The distance from the mine to the lower camp on the bank of the river is three miles by trail and about 7,400 feet by air-line. The lower camp, which is situated near the mouth of McGuire creek, consists of two small cabins, from whence a trail leads up to the mine cabin, which has accommodation for four men. The mountain-side rises abruptly from the river and becomes precipitous in the vicinity of the workings.

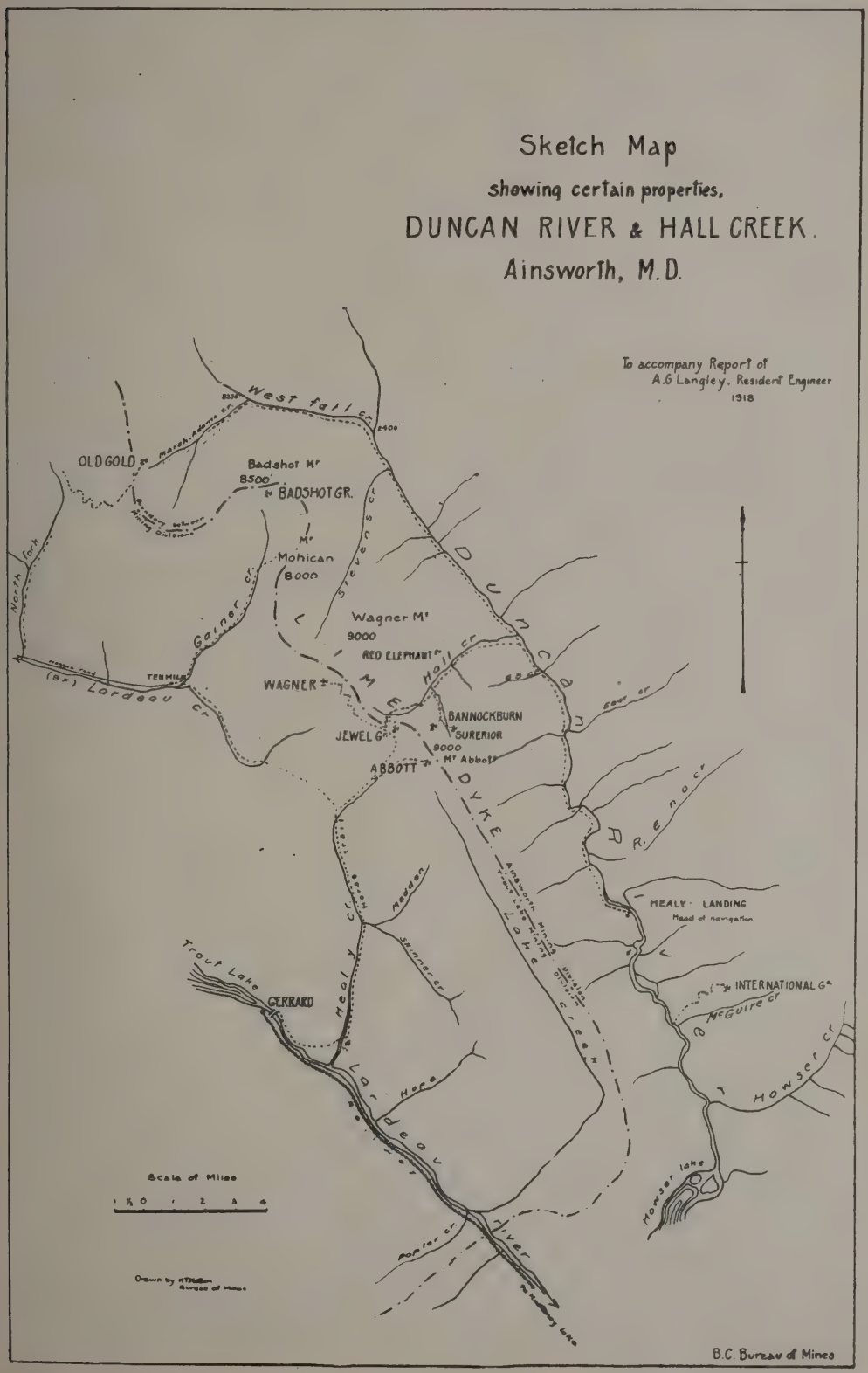
The vein, which is a fissure of the bedded variety occurring in a schist formation, has an average width of 2 feet, is composed of crushed and shattered quartz, and dips at an angle of 30 degrees in an easterly direction. The ore occurs in small pockets and lenses at irregular intervals. The predominating ore-mineral is galena, with which is associated tetrahedrite, sphalerite, and iron pyrites. The old workings, which consist of a 25-foot drift and a few open-cuts, do not expose much ore in commercial quantities.

Following around the side of the bluff for a short distance from these workings, the vein is exposed along the trail for a distance of about 50 feet, in which occurs a streak of galena about 4 inches wide and about 15 feet long, a sample across which ran as follows: Silver, 13 oz.; lead, 37.7 per cent.; zinc, 1.2 per cent. Recent work consisted of driving a crosscut to tap the vein at a depth of approximately 50 feet below the old workings. This was in a distance of 65 feet at the time of my visit.

The property is in the prospective stage of development, and should sufficient ore be developed to warrant the erection of any plant, the conditions are admirably suitable for an aerial tramway to the river, while there is reported to be a good mill-site available on McGuire creek.

Hall Creek Properties.

For some years there has been a certain amount of agitation for the Government to build a wagon-road up the Duncan river from Idaho Landing, the head of navigation to Hall creek, in order to give access to mining properties located in this vicinity. Upon request from the Hon. Minister of Mines, a trip was taken into this part of the country to report on the existing conditions, and ascertain, if possible, whether assistance from the Department of Mines under the "Mineral Survey and Development Act" towards building twelve or fourteen miles of road up the Duncan river would be warranted at the present time.


Skeich Map
showing certain properties,
DUNCAN RIVER & HALL CREEK.
Ainsworth, M.D.
To accompany Report of
A.G Langley. Resident Engineer
1918
West fall cr
OLD GOLD
Badshot Mt
8500'
BADSHOT GR.
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Stevens cr
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North fork
Gainer cr
Wagner Mt
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RED ELEPHANT
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Hall cr
TEN MILE
(or) Lardeau cr
JEWEL Gr
BANNOCKBURN
SURERIOR
9000
Mt Abbott
ABBOTT
DYKE
East cr
Reno cr
MEALY LANDING
Head of navigation
Ainsworth
LAKE
Meadow
Shanner cr
Trout Lake
GERRARD
Mealy cr
INTERNATIONAL Gr
McGuire cr
HOWSER cr
Lardeau River
Howser lake
Poplar cr
Scale of Miles
B.C. Bureau of Mines

Hall creek flows into the Duncan river at a point about twenty-two miles north of Howser lake. There are two routes which give access to the properties on this creek and those situated in the mountainous area of country from which it derives its source. One is by Healy creek from Gerrard and the other by way of the Duncan river from Howser. If the former route is chosen, horses can be taken from Gerrard and headquarters made at the *Jewel* cabin, which is situated on the summit of the divide between Hall and Healy creeks, from which point short trips can be made to the various properties.

The Healy Creek trail leaves Gerrard and follows the Lardeau for about five miles, crosses Healy creek at a point about three miles from its mouth, and then follows up the creek for a distance of fifteen miles to the base of Abbott mountain, from whence it ascends at a steep grade past the old *Abbott* cabins to the *Jewel* cabin, and thence to the *Wagner*, making a total distance of between eighteen and twenty miles from Gerrard.

The Healy Creek trail is not good, but is passable, and horses can be ridden for the whole distance. In order to eliminate a bad part of the trail, which is expensive to maintain, and also in order to shorten the distance to the railway, the Government is building a bridge across the Lardeau river at a point three miles below Gerrard. From the base of Abbott mountain to the bridge crossing on Healy creek a good wagon-road grade not exceeding 4 per cent. is obtainable. A wagon-road, however, would be both expensive to build and costly to maintain on account of a number of slides which would have to be crossed.

To reach the properties by the Duncan River route a launch is taken from Howser to Healy's Landing, a distance of approximately twenty miles; from this point horses may be obtained, and the trail followed for twelve miles up the Duncan and six miles up Hall creek to the *Bannockburn* group, making a total distance from Howser of thirty-eight miles.

The latter route is the easier of the two if one should wish to visit the properties on Hall creek, while the other is better if one should wish to get a general idea of the country at the head of Hall creek, and visit the *Abbott*, *Wagner*, and *Jewel* properties. The natural outlet to the *Bannockburn*, *Superior*, and *Red Elephant* groups is via Hall creek to the Duncan river. Although Hall creek offers an outlet to the *Wagner* and *Jewel* properties, the owners prefer the Healy Creek route, it being shorter and more direct to the railway.

When contemplating a road down the Duncan to the head of navigation, the question of water transportation has got to be taken into consideration, and although no data is available on the navigability of this river, it is probably not navigable for more than four months in the year, and even then a good deal of money might have to be spent in removing log-jams, sand-bars, and snags.

Bannockburn Group.

This property, consisting of seven Crown-granted claims, is situated near the headwaters of a glacial-fed stream known as Bannockburn creek. This creek is a tributary to Hall creek and enters the latter at a point about five miles from the Duncan river. In order to reach the camp, which is situated at an elevation of 5,775 feet, or about 2,000 feet above Hall creek, a fairly steep climb is necessary. The camp consists of a good cabin, having sufficient accommodation for three or four men, and a walled tent. The site is well chosen, as there is plenty of timber available both for mining and domestic purposes, while water is obtainable from a near-by creek. It is possible that sufficient water-power could be developed during the summer months to run a small compressor from Bannockburn creek, which is only a short distance below the cabin.

In the immediate vicinity of the outcrops the formation consists of thin intercalating bands of limestone and light-brown fissile schist. The ore apparently occurs along the contact of the limestone and schist, replacing the limestone. The strike of the formation is N. 38° W. and dips at an angle of 65 degrees to the north-east. The ore on the surface consists of massive galena and a little zinc-blende, mixed with iron-stained ledge-matter.

The deposit has been uncovered at a number of places by shallow surface diggings, which indicate the known length of the deposit to be about 200 feet. The ore shows continuity along the surface, for at each place where the surface soil has been removed ore is exposed in widths varying from 20 inches to 5 feet. A sample across a width of 5 feet at No. 3 open-cut ran as follows: Gold, 0.30 oz.; silver, 27.5 oz.; zinc, 3 per cent. Some years ago a 40-foot shaft was sunk on the strike of the ore, but the development evidently did not come up to expectations, for it was abandoned, and no recent attempt has been made to further exploit the ore-body at this point.

At 100 feet below the No. 1 showing, at the north-western extremity of the deposit, a crosscut has been run for a distance of 107 feet. This has been driven in a white crystalline limestone, and so far has not encountered any ore. At a distance of 90 feet from the portal a quartz-filled fissure was encountered; this was drifted on for 118 feet, but no ore was developed. This fissure occurs vertically below the line of the outcrop.

Two other showings on the property were examined—one in a southerly direction and about 400 feet above the No. 5 open-cut, and the other about 500 feet in a northerly direction from the No. 1 open-cut; but in both cases the showings appeared to be isolated, and the formation being broken and shattered made it impossible to form any idea as to future possibilities or to connect them with any vein system.

With such strong surface showings, it would be reasonable to suppose that ore would be found at a depth, but before doing any extensive crosscutting more work might be done to advantage on the surface, by uncovering more of the ore and sinking shallow shafts to find out definitely the character of the deposit.

Superior Group. These claims are situated on Hall creek and adjoin the *Bannockburn* to the south-east and east. Development-work was started on the property in the fall of 1917 by Brown Bros., the original owners, who bonded it to Conaway & Birch, of California. The vein apparently occurs along the contact of schist and limestone, and is completely covered by slide material and glacial talus, through which three crosscut tunnels have been run. The uppermost strikes the vein at a distance of 15 feet, and exposes about 6 feet of ledge-matter in the bottom, the mineralization consisting of galena, zinc-blende, and iron pyrites; the gangue, which is composed of lime and silica, is decomposed and stained with oxide of iron.

The second tunnel strikes the vein at a distance of about 100 feet, and the third had been driven for a distance of 176 feet when work had to be discontinued on account of a heavy flow of water from the glacial ice immediately above the slide. It was the intention of the owners to continue this work as soon as the weather became cooler and the flow of water abated. Prospecting-work by means of open-cuts and short tunnels was being carried on at another showing farther down the hill to the east of the *Bannockburn* cabin. The property is in the prospective stage of development, and until further work has been done it is difficult to form an opinion as to its future possibilities.

Red Elephant Group. This group, comprising four claims, is situated at an elevation of 4,450 feet, or 700 feet above Hall creek, and within four miles of the mouth of the creek. The property is owned by J. W. Power and Hugh MacKay, of Kaslo. The development-work principally consists of about 150 feet of tunnelling in decomposed, rusty-coloured schist. A sample taken across a width of 6 feet of this material in the tunnel only ran 0.10 oz. in gold. A sample of decomposed silicified schist and honeycombed quartz exposed in an open-cut near the portal of the tunnel gave 1.24 oz. in gold. On the top of a small ridge, and a height of about 50 feet above the tunnel, there is another exposure of similar material to that found in the open-cut.

The good gold values obtained, its easy accessibility, and proximity to ample water for power and milling purposes make it an attractive prospect well worthy of close investigation. Very little work, if any, has been done on the property since it was examined by the Provincial Mineralogist, whose report may be seen in the Annual Report for 1909, page 112.

Wagner Group. This property consists of six claims and two fractions staked in a north-westerly direction and running parallel to the lime dyke-belt. The names of the claims are as follows: *Ella*, *Ould Jim*, *Duncan*, *Lardo*, *Queen Mary*, *Princess Mary*, *Lardo Fraction*, and *McCartney Fraction*. The property is owned by the Wagner Mines, Limited, of which C. T. Porter, of Spokane, is one of the principal parties interested. The location of the mine-workings, which are situated at an elevation of 8,200 feet, is somewhat unique. The vein-outcrops near the top are a small knoll which extrudes through the glacial ice covering the summit of the divide between Hall and Cariboo creeks, and in order to reach the tunnel one has to travel over the glacier for at least a quarter of a mile. The natural conditions only allow accessibility at certain times of the year, but when once at the workings, as Mr. Porter says, there is no danger from snowslides, for you are well above them. No work of any importance has been done since 1897.

The development-work consists of a drift along the vein for 100 feet, at the end of which a crosscut has been driven. These workings are approximately 200 feet below the top of the knoll, where the vein outcrops and exposes a nice surface showing of galena. At 49 feet from the portal of the drift a station has been cut, and, according to information received from C. T. Porter, a 54-foot winze was sunk, at the bottom of which a drift was run for a distance of 15 feet in a north-westerly direction, from the end of which a 20-foot crosscut exposed a 12-foot width of vein-matter. Assays taken from this crosscut gave the following values: Silver, 100 to 170 oz.; lead, 60 to 63 per cent. These workings were full of water and therefore could not be examined.

The crosscut at the end of the main drift has been driven for a distance of 46 feet. This exposes a 10-foot cross-section of the vein near the point of intersection of the main drift. This section shows a 2-foot width of ore, a sample across which ran: Gold, 0.02 oz.; silver, 22 oz.; lead, 21 per cent.; zinc, 17.4 per cent; the remaining 8 feet of the vein is only slightly mineralized. In view of the high values obtained from the bottom of the winze, this crosscut possibly cuts the vein near the end of the ore-shoot. The vein dips at an angle of 65 degrees to the south-west and has a strike of N. 65° W.

The country-rock consists of dark slates, which in this vicinity are somewhat contorted and faulted. (For further reference to this property *see* Report of 1909, page 109.) Following the strike of the vein in a south-easterly direction, similar vein-matter and ore are found on the *Lardo* claim, about 1,000 feet below the *Wagner*, in the old *Jewel* workings on the south side of Hall creek, and again on the *Abbott* claim, which would indicate the possibility of all these claims, which cover a distance of about three miles, being located on the same vein, although the heavy overburden of glacial drift, detritus, and ice make tracing of the vein impossible except at a few places. A little work was done on the *Jewel* group some years ago, but these workings are now caved. The vein, which is mostly covered with detritus, consists of broken fragments of slate and occurs in a crushed slate formation similar in character to that of the *Wagner*. A grab sample from a 6-ton pile of ore on the old dump ran as follows: Gold, 0.02 oz.; silver, 34.8 oz.; lead, 40 per cent.; zinc, 4.8 per cent.

In the past only spasmodic attempts have been made to develop ore in any of these properties, which is hardly to be wondered at considering the inaccessibility, which makes the cost of packing prohibitive. However, conditions would appear to warrant some work being done on the vein at the most favourable places, where natural conditions do not too seriously handicap or interfere with mining operations.

In the event of sufficient ore being developed to justify the building of a road down Healy creek, ore could be hauled from the foot of Abbott mountain to the railway at a cost not exceeding $5 a ton.

SLOCAN MINING DIVISION.

SANDON CAMP.

Conditions in the Sandon camp have been better than for many years past, and the prospects for a large increase in production from the surrounding district is most encouraging, providing market conditions remain favourable.

Clarence Cunningham, who has been carrying on progressive mining and development work at his various properties, has done a lot to stimulate the industry in the Slocan and elsewhere.

Besides the *Queen Bess*, which is proving to be one of the richest mines in the Division, he is operating the following properties, in which, all told, about 250 men are employed: *Idaho-Alamo, Sovereign, Wonderful, Van-Roi, Hewitt,* and *Wakefield.*

The Surprise Mining Company has also been very active this year, and recently acquired the *Ivanhoe* group and adjoining claims of the *Adams* group. The company is also operating the *Bosun* mine, where sixty men are being employed. The ore from this mine is concentrated at the Rosebery mill. The entire output from the properties operated by this company is shipped to the United States for reduction, under arrangements of a long-term contract.

Slocan Star.—This mine is now being operated by the Silversmith Mines, Limited, under the management of R. H. Stewart. A large shoot of ore was recently developed on the tenth level, which is the lowest point in elevation in the Sandon camp at which ore has been developed. After nearly a year's idleness the mill was again started in October, and it is to be now hoped that the mine will once more rank among the leading producers of the district.

Noble Five.—Work is progressing satisfactorily on the four-compartment vertical raise, being driven to connect the lower workings and the main adit-tunnel with the upper workings.

Ruth.—Work has been continued on the driving of the long crosscut.

Payne.—Leasers have been on this property, and small shipments have been made to Trail.

Mountain Con.—Development-work has been continued. Unfortunately the principal owner, W. Bennett, and another man lost their lives in a snowslide this fall. Mr. Bennett was an old-timer in the Slocan and his loss will be greatly regretted by the mining community.

Rambler-Cariboo.—This property has been steadily operated under the management of W. A. Cameron, although during the early part of the year the company suffered material loss from a heavy snowslide.

Noonday.—Development-work has been carried on under the direction of Bruce White, who recently died at Nelson from pneumonia, following an attack of influenza. Mr. White was one of the first men to find his way into the Slocan country, and staked the *Slocan Star* in 1891. He was liked and respected by all who knew him, and has done a lot to attract attention to the mineral wealth of the Kootenays.

Carnation.—This property has been steadily developed under the supervision of G. W. Clarke. The amount of tunnelling done since mining operations started in the fall of 1917 is 638 feet; upraising, 190 feet; crosscutting, 105 feet. The results so far obtained are said to be encouraging.

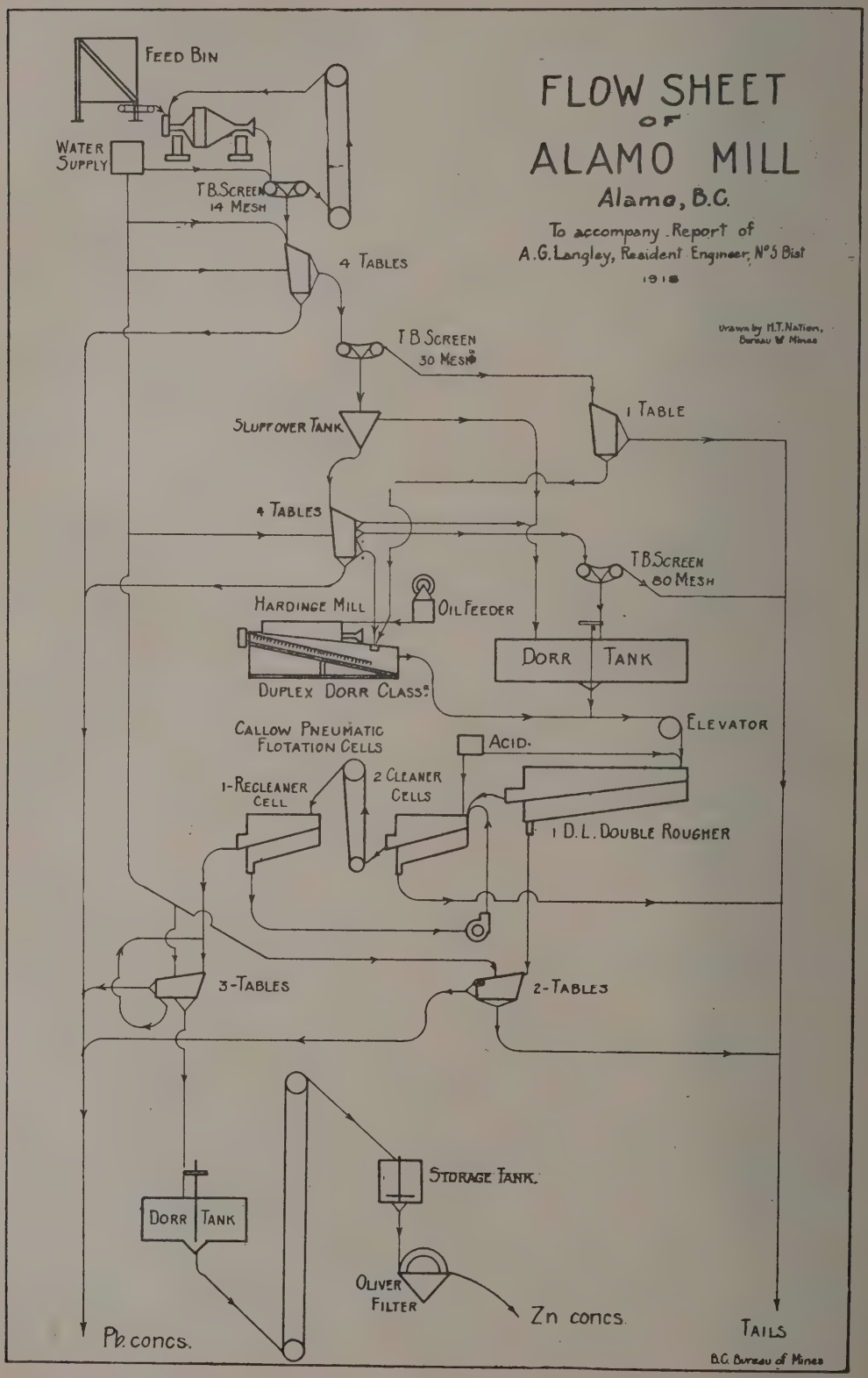
Alamo Concentrator.—Situated at Alamo, on the Kaslo-Nakusp Railway. Built and designed by the General Engineering Company, of Salt Lake, for Clarence Cunningham. The mill was designed for treating ore from the *Wonderful* mine. Ore will also be treated from the *Queen Bess* and *Idaho-Alamo* properties, which will be directly transported by aerial tramway to the mill-bins. Provision is also made for handling ore from the railway-track to the mill-bins, the present capacity of which is 700 tons. The capacity of the plant is 150 tons in 24 hours. Water-power is derived from the North fork of Carpenter creek. The distance from the intake to the mill is approximately two miles. The water is conveyed by a 22-inch diameter steel pipe-line. The head of water obtained at the mill is 210 feet.

A 225-horse-power Pelton wheel drives the entire mill, including a lighting-generater. A 45-horse-power Pelton wheel is provided as a spare, and in case of a shut-down would be used for operating the lighting plant and the mechanism of the Dorr tanks. As will be noticed by the flow-sheet, jigs have been eliminated and the fine grinding is done entirely by Hardinge mills, while the sizing and classifying is done by three Callow travelling-belt screens and one duplex Dorr classifier. The zinc and lead flotation product is separated on tables; selective flotation is not attempted. The tables used are all Wilfley. About 75 per cent. of the total lead is recovered by water-concentration. The zinc contents of the ore are recovered by Callow pneumatic flotation-cells.

The floor-space of the building is divided as follows: Upper bin, 20 x 28 feet; upper ball-mill floor, 20 x 48 feet; upper Wilfley table floor, 48 x 50 feet; lower ball-mill and Dorr classifier floor, 21 x 48 feet; lower table floor, 24 x 60 feet; flotation floor, 15 x 60 feet; tank building, 63 x 96 feet; concentrate-bins, 12 x 88 feet. The difference in elevation from the bottom of the feed-bin to the railway-track is 56 feet.

North Fork of Carpenter Creek.

Jo-Jo. This property, consisting of two claims, is owned by T. Trenary, who staked it in 1894, and is situated on the North fork of Carpenter creek at a distance of five miles and a half from Three Forks. The elevation of the cabin is 4,850 feet. The vein is developed by two adit-tunnels driven at a vertical distance of 130 feet apart. Ore was first extracted from the upper workings, where a 90-foot crosscut intersected a narrow quartz vein carrying high values in silver; this was drifted on for 112 feet in an easterly direction, and at 67 feet from the crosscut a small shoot of high-grade ore was stoped to within a few feet of the surface, when it had to be abandoned on account of water coming in from the creek-bed. The drift was continued in a westerly direction from the crosscut for a distance of 38 feet, at which point a winze connects with the lower tunnel. The dump from these upper workings, which was said to have contained about 200 tons, was carried away by a snowslide last spring, with the exception of about 15 tons, a grab sample of which ran: Silver, 22.5 oz.; lead, *nil;* zinc, 3.6 per cent.


FLOW SHEET
OF
ALAMO MILL
Alamo, B.C.
To accompany Report of
A.G. Langley, Resident Engineer, N°5 Dist
1918
Drawn by M.T. Nation,
Bureau of Mines
FEED BIN
WATER SUPPLY
T.B. SCREEN 14 MESH
4 TABLES
T.B. SCREEN 30 MESH
SLUFFOVER TANK
1 TABLE
4 TABLES
T.B. SCREEN 80 MESH
HARDINGE MILL
OIL FEEDER
DUPLEX DORR CLASS.
DORR TANK
ELEVATOR
CALLOW PNEUMATIC FLOTATION CELLS
ACID.
1-RECLEANER CELL
2 CLEANER CELLS
1 D.L. DOUBLE ROUGHER
3-TABLES
2-TABLES
STORAGE TANK.
DORR TANK
OLIVER FILTER
Zn concs.
Pb. concs.
TAILS
B.C. Bureau of Mines

In the lower workings the vein has been followed for a considerable distance and a little ore stoped at intervals. The vein, consisting of white brittle quartz, occurs in a crushed zone of black slate, which is characteristic of the Slocan series. The walls are not well defined, while the strike and dip are irregular, but lenses of quartz occurring at intervals, and having a maximum width varying from a few inches to about 2 feet, carry high silver values. The ore principally consists of argentite, tetrahedrite, and native silver in a highly siliceous gangue.

On account of the high cost of packing to Three Forks, the ore is carefully sorted and cobbed before shipping, with the result that the product is high grade. Two men who had the property under lease this year shipped 10 tons from the lower tunnel, which ran as follows: Silver, 324 oz.; lead, 4.7 per cent.; zinc, 5 per cent. The second-grade ore or reject from this shipment formed a dump of about 50 tons, a grab sample of which ran: Silver, 22.5 oz.; lead, *nil.*; zinc, 3.6 per cent.

Present development-work is being confined to continuing the lower drift, with the object of getting under the shoot of ore in the upper level. There is sufficient water in a near-by creek for camp requirements and possibly for a small mill, although if any quantity of ore is developed a mill-site could be obtained on the North fork of Carpenter creek. Although there is not much ore in sight at present, it is an attractive property on account of the high silver values, and on which more development-work might be done to advantage.

Milton Group. These claims adjoin the *Jo-Jo* higher up the hillside. The property belongs to R. McPherson and S. McGregor, of Kaslo. Only a cursory examination was made of the somewhat extensive workings. R. McPherson for many years has diligently worked at the development of the claims, and has accomplished a phenomenal amount of work single-handed. Altogether there is about 1,500 feet of tunnelling besides a considerable amount of surface work. The underground workings are in first-class condition, the tunnels have plenty of clearance, and the timbering is well done. There are several quartz veins exposed, one of which is similar in character to the *Jo-Jo* vein. The possibilities of the property can only be determined by a careful examination and sampling, which would have taken more time than the writer had at his disposal on this occasion, but another trip is contemplated.

Black Grouse.—Situated at a distance of two miles from Three Forks. Some work was done by G. Murhard, the owner, during the summer.

The ore from properties on this creek carry high silver values and are low in lead and zinc.

Silverton Camp.

This camp has been a little quieter than usual on account of the temporary close-down of the *Standard* mine, which for many years has been the leading shipper of the Slocan. However, further development-work is being done, and it is to be hoped that before long it will again become one of the large shippers. In the meantime the mine is being partly worked under lease by L. McPhee and partner. Small shipments are now being made to Trail.

Echo.—This mine, situated above the *Standard* and on the same lead, promises to be an important shipper in the near future. Arrangements have been made to lease the *Standard* mill, and a tramway has been built from the mine to connect with the Standard tram. J. P. Bonner is mine superintendent.

Galena Farm.—This property was worked during the summer under the supervision of P. Clarke, of Spokane. After a short close-down the mine was leased to the foreman, J. Casey. A new shoot of ore was recently developed.

Van-Roi and *Hewitt.*—These properties are being systematically mined and developed under the management of C. Cuchin Moore. About 100 men are employed.

Wakefield.—This property was recently acquired by Clarence Cunningham and is now being developed under the supervision of Oscar White. About seven men are employed.

Bosun.—Besides the mining and development work being carried on in the upper levels of the mine, the lower or No. 6 tunnel is now being driven to tap the vein. This tunnel will gain a depth of nearly 800 feet on the vein at a point under the main workings. A 100-horse-power boiler and a 600-foot Ingersoll Rand compressor have been installed near the lake. S. R. Moore is mine superintendent. Sixty men are employed.

Molly Hughes.—Situated on Slocan lake, near New Denver. The property is being mined by the owner, H. Cleaver, of New Denver. A few men are working and a small shipment was made to Trail.

Lucky Thought.—This property has been operated by the Consolidated Mining and Smelting Company and a small shipment was made to Trail.

The following is a list of shippers of the Slocan Mining Division, giving the approximate tonnage shipped or milled by each property during the year:—

	Ore Tons.
Anna group, Sandon	17
Best, Rambler	37
Canadian group, Sandon	11
Echo, Silverton	44
Freddy Lee, Sandon	40
Gem, Sandon	7
Idaho-Alamo, Sandon	184
Ivanhoe, Sandon	53
Jo-Jo, Three Forks	10
Lucky Jim, Zincton	1,724
No. 1, Sandon	111
Payne, Sandon	49
Queen Bess, Sandon	5,314
Rambler-Cariboo, Rambler	7,138
Reco, Sandon	37
Richmond-Eureka, Sandon	66
Ruth	33
Silversmith, Sandon	315
Sovereign, Sandon	240
Surprise, Sandon	13,998
Bosun, Sandon	27,764
Wonderful, Sandon	100
Standard, Silverton	34,727
Galena Farm, Silverton	5,250
Van-Roi, Silverton	25,278
Hewitt, Silverton	19,399
Lucky Thought, Silverton	123
Molly Hughes, New Denver	19
Caledonia	19

L. & H. This property, comprising the following mineral claims: The *L. & H.*, *Summit*, *Camden*, *Harlen*, *St. Joe*, *Basin Fraction*, *C.B.*, and *Baby Ruth*, is owned by F. Fingland and C. Brandt, who have worked the property for a number of years. It is situated at a distance of five miles and a half from Silverton and is easily accessible by wagon-road from this place. The elevation of the camp-site is about 5,250 feet above sea-level. J. D. Galloway's report, published in the 1915 Annual Report, fully describes the property, so the matter will only be briefly dealt with.

The claims are located in a greatly disturbed area of sedimentary rocks, cut by dykes and pegmatite veins. This area, which is only a few miles in extent, is surrounded by the granitic rocks of the Nelson batholith. The ore, consisting of an intimate mixture of pyrite, arsenopyrite, and pyrrhotite, carries average values in gold of about $6 a ton. These sulphides have been deposited in a highly silicified slate, and the mineralization occurs in proximity to intrusive dykes, which apparently bear a close relationship to, and are genetically connected with, the ore-body. The ore outcrops on the side of a steep bluff and is developed by means of two adit-tunnels. The vertical distance between these tunnels is 90 feet. A third tunnel is now being driven which will give an additional depth of 250 feet. This tunnel is now in about 200 feet, and they yet have about 200 feet to drive in order to reach a point below the upper workings, where some 30,000 tons has been developed.

Should the ore-body be developed in the lowest tunnel and its continuity proved to the upper level, there will be sufficient ore available to justify the large expenditure which will be necessary

to erect a power plant, mill, and tramway in order to mine, treat, and handle the ore on a large and economical scale.

The owners have a mill-site near the mouth of Eight-mile creek, where, it is estimated, enough power can be developed for mining and milling purposes. The prospects for the development of a large low-grade ore-body are encouraging, and conditions appear to fully warrant the work which is now being done.

Midnight Group. This group is situated to the east of the *Noonday*, which adjoins the *Galena Farm* property. The claims are easily accessible, being only a short distance from the road leading to the *L. & H.* mine. R. MacFarland and A. S. Calany, of Silverton, are the owners. A prospect-tunnel has been driven for 160 feet, and a small well-mineralized quartz vein is exposed along the bottom of the drift for about 75 feet. A sample of select specimens from the dump ran: Silver, 137.4 oz.; lead, 2 per cent.; zinc, 24 per cent. The small quantity of ore so far exposed is a mixture of galena and sphalerite, with which is associated small quantities of tetrahedrite.

The tunnel gains very little backs, as the hill slopes at a slight angle. The apparent strike of the vein is N. 83° E. and the dip 70 degrees to the north. Further work might be done to advantage by sinking on the vein and by doing a little crosscut work to determine the true foot-wall.

Le Roi, Baltimore, and Silver Wedge. These claims, owned by W. H. Dawson, of Victoria, are now under bond to T. Lloyd and others, of New Denver. The property is situated on Granite creek, the claims being staked along the easterly extension of the *Van-Roi* veins. In the lower workings a considerable amount of drifting and crosscutting has been done on what is supposed to be the north vein, while farther up the hill a short tunnel has been driven and a shaft sunk on presumably the south vein. At these latter workings a vein 10 inches wide is exposed in the bottom of a 10-foot shaft; this vein is highly mineralized with zinc-blende. A sample from sorted ore on the dump ran: Silver, 2 oz.; lead, trace; zinc, 44 per cent.

In the lower workings there is a small showing of galena at the intersection of the main drift and a crosscut, but as yet no ore has been developed which might be considered of commercial importance, although the conditions appear favourable for further prospecting. The vein, occurring in a sheared zone of black slates, is brecciated in character and has been subject to faulting.

SLOCAN CITY MINING DIVISION.

There has apparently been more activity in this Division than last year. Generally speaking, the ores are "dry ores" containing high silver values, with small percentages of lead.

Meteor.—J. C. Buchanan, who is also interested in the *Lily B.* mine, recently took an option on this property. The results obtained from preliminary development-work are reported to be of a highly satisfactory nature. Preparations are now being made for the immediate installation of a compressor plant, while it is possible that a mill will be erected at a later date.

Lily B.—This season's work was confined to driving a crosscut to tap the vein at a depth. Work was discontinued this fall.

Arlington.—M. Davys, of Kaslo, who has secured a lease of the mine and ore-dumps, has started to make shipments from the latter to the Trail smelter. It is estimated that there are approximately 10,000 tons in the dumps, and he proposes to erect a concentrator to treat the second-grade ore, which will not stand shipment.

Enterprise.—Situated on Ten-mile creek. Work has recently been started on this property by Earle Hyde, who is confining his attention to the development of a parallel vein to the one which was worked previously. About seven men are employed at the property.

Ottawa.—This property has been mined by the Consolidated Mining and Smelting Company and a small shipment made to Trail.

Black Prince.—F. Tipping put in a season's work on this property, which is a small but steady shipper.

Republic.—G. E. Laird was in charge of the mining operations at this property during the summer.

Westmount.—Situated on Ten-mile creek. Worked under lease by H. Lee.

The following shipments were made: *Arlington*, 375 tons; *Ottawa*, 48 tons; *Black Prince*, 30 tons; *Republic*, 14 tons; *Westmount*, 49 tons; *Lily B.*, 15 tons.

NELSON MINING DIVISION.

Southern Belle. This claim was originally staked by C. E. Wilson, of Salmo, in 1895. It is situated on Wilson creek at a distance of twelve miles from Salmo, the nearest shipping point. Recently a company was incorporated at Trail, called the Trail Mining Company, in which Joe Rozeck, Cavin Hicks, and others are interested. This company acquired the property and adjoining claims with the intention of driving a long crosscut to tap the vein at a depth, but beyond building a new cabin near the proposed tunnel-site did not make much progress this year. It is reported that there is some dispute regarding the ownership of one of the claims, and that work has been suspended until settlement is arrived at.

The quartz vein, which occurs in a crushed zone of dark slate and schist probably belonging to the Carboniferous period, is not well defined and is only found in broken segments, none of which yet developed is large enough to demonstrate the existence of an ore-body of commercial importance; hence the property is still in its prospective stage. Geological conditions appear favourable for the existence of ore, or, as the prospector would say, "it is good-looking ground," and further development at a depth may possibly disclose more ore.

Briefly, the principal workings consist of two crosscuts and a little drifting. At the lower workings a crosscut has been driven for a distance of 137 feet. At a distance of 98 feet from the portal, ledge-matter was struck, which was drifted on in a westerly direction for 43 feet. No ore was encountered. At 130 feet from the portal a drift was started in a north-easterly direction and run for a distance of 29 feet. This exposes a short length of a small quartz vein, a sample across 12 inches of which ran: Gold, 0.02 oz.; silver, 4 oz.; lead, 3.5 per cent.; zinc, 1 per cent.

The upper workings are situated at a distance of about 900 feet in a westerly direction from and approximately 150 feet higher than the lower tunnel. Here a crosscut intersects a narrow quartz vein at a distance of 136 feet from the portal, and was drifted on for a distance of 50 feet in a westerly direction; the end of the drift terminates in an inclined winze, which gains a depth of 31 feet on the vein. At the bottom of the winze a small section of the vein has been uncovered, which showed a width of about 20 inches, with a pay-streak of 4 inches of clean galena. Near the intersection of the crosscut and this drift a 20-foot raise exposes a width of 17 inches of vein-matter, a sample across which ran: Gold, trace; silver, 2.4 oz.; lead, 6.5 per cent.; zinc, 1.2 per cent. This drift was also continued for 73 feet in an easterly direction from the crosscut, but no ore was developed. A few tons of sorted ore which was shipped early in the year ran: Silver, 27.3 oz.; lead, 30 per cent.; zinc, 0.8 per cent.

Nevada Group. This property, consisting of six claims—the *Jumbo No. 1*, *Jumbo No. 2*, *Climax*, *Gladstone*, *Boulder*, and *Chief*—is owned by D. M. Mowat and W. McIntosh, of Salmo. The claims are situated on the Lost Creek slope of Nevada mountain, at a distance by trail of four miles from the *Emerald* mine. The elevation of the main tunnel is 5,000 feet. At the upper tunnel, which has been driven for a distance of 93 feet, gold and silver values have been found in a quartz vein which occurs in a crushed zone along the contact of the granite and slate. The crushed material and vein-matter is highly mineralized with iron pyrites, which in places has been altered by oxidation to a soft, dark-brown amorphous material. Very little backs are obtained by this tunnel, and not sufficient work has been done to prove the continuity of the vein. A sample of a 6-ton pile of sorted ore from this tunnel ran: Gold, 0.48 oz.; silver, 2.1 oz.; while a sample across a width of 27 inches at the face of the drift ran: Gold, 0.2 oz.; silver, 4.5 oz.

A lower tunnel was driven some years ago along a quartz-filled fissure in the granite. The length of this drift is 75 feet and the vein can be traced for its entire length. A sample across a width of 24 inches ran: Gold, trace; silver, 0.4 oz. There is a good cabin on the property within convenient distance of the workings.

Gold Hill Group. There are six claims in this group; those on which the work has been done belong to Alex. McDonald, while some of the adjoining claims are held by L. Gallagher. The property is situated near the headwaters of 49 creek, at an elevation of 4,960 feet, and at a distance of eight miles and a half from Granite Station, which is the nearest shipping-point. The road leading to the claims passes the *May & Jennie* mill on the way up 49 creek. This mill has recently been dismantled. The workings principally consist of a long crosscut tunnel which strikes the vein at a distance of approximately 500 feet from

the portal. At this point the vein has been stripped on either side, leaving a pillar or ore 12 feet long by 6 feet high and about 12 inches thick. At the northerly end of this showing the ore is exposed in a 17-foot raise, where it shows a width of 15 inches, and across which a sample was taken, which ran as follows: Gold, 8.5 oz.; silver, 4.4 oz.; copper, 4.4 per cent.

Just beyond the raise the vein is cut off by an intrusive dyke, and work has not been continued for any distance in this direction. At a short distance from the raise in a southerly direction a 15-foot winze was sunk on the vein and exposes ore in the bottom, while just south of the winze a small lens of ore having a maximum width of 7 inches gave the following values from a sample taken across same: Gold, 6.88 oz.; silver, 4 oz.; copper, 4.2 per cent. The vein, which has a brecciated structure, occurs in a dark schist and has a strike of N. 10° W. and an almost vertical dip. The mineralization consists of iron pyrites, arsenopyrite, chalcopyrite, and chrysocolla. The gold values are probably associated with the iron pyrites and arsenopyrite. The above-mentioned workings develop the vein at a vertical distance of about 300 feet below the surface.

Sheep Creek Camp.

Emerald.—Mining and development work have been steadily carried on with satisfactory results. This property is the largest producer of lead-silver ore in the district. Between twenty and thirty men were employed. According to information received, the mine closed down temporarily on December 7th.

Ore Hill.—Mining operations have been carried on under the management of W. De Witt. Four or five men were employed.

Aspen.—A few men have been working at this property. A new trail was built between the *H.B.* camp and the mine.

Reno.—Situated on Fawn creek, above the *Nugget* mill. W. B. Poole put in a season's work on the property and reports the finding of two new veins. The ore is gold quartz.

The Sheep Creek gold camp, in which is located the *Motherlode*, *Nugget*, *Kootenay Belle*, and *Queen* mines, is one of the most important gold-bearing areas in the Kootenays. The gold-bearing quartz veins are of the true fissure type and traverse a quartzite and schist formation. The values occur in well-defined shoots. All the properties have been closed down during recent years, which may be partly accounted for by the increase in the cost of labour and supplies during the war under which conditions the mining of low-grade gold properties could not be carried on to advantage. Recently, however, A. W. McCune, of Salt Lake City, bonded the *Queen* and some of the adjoining properties, and a long crosscut tunnel is now being driven to tap the vein system at a depth.

The Nugget Gold Mines, Limited, has been organized to develop the *Motherlode*, *Searchlight*, and *Nugget* properties, and I understand that the preliminary development-work will consist of driving a 1,200-foot crosscut to connect the *Motherlode* and *Nugget* workings. This undoubtedly is the most economic manner in which to develop and operate the *Nugget* mine. Should results come up to expectations, we will shortly see a substantial gold production from this camp, which up to the end of 1915 produced about $2,500,000 in gold.

Spokane Group.—This property, which is situated on the easterly side of the Sheep Creek divide, has been developed by the Laib Bros., and 20 tons of high-grade ore has been packed out.

Yankee Girl.—Situated near Ymir. This mine has been steadily operated during the year under the management of W. T. McDowell. Shipments have been made to the Greenwood smelter, from which the mine received very favourable smelting rates. Mining operations temporarily ceased early in December, which may partly be attributed to the closing-down of this smelter.

Other Properties.

Relief.—Situated near Erie. The season's work has been principally confined to the building of a new flume. Plans are being prepared for reorganization, with a view to obtaining more capital in order to continue operations on a larger scale. A. D. Westby is manager.

California.—Situated near Nelson. Development-work is being continued. About six men are employed.

Monarch Group.—Situated near Beasley. Development-work has been carried on during the year. Four or five men employed. The principal values are in copper.

Silver King.—The Consolidated Mining and Smelting Company has had a small crew of men employed during the season.

Eureka.—Now being operated by the Inland Mining Company, of Walla Walla, with head office at Nelson. W. M. Myers is mine manager. Work done by the previous owners during the early part of the year consisted of erecting a 1,100-foot 2-bucket tram, new bins, and extending the *Granite-Poorman* tramway for 3,000 feet across Kootenay river to the railway. The ore carries values in gold, silver, and copper. Twelve men are employed.

Molly Gibson.—This mine has been operated by the Consolidated Mining and Smelting Company. Motor-haulage from the mill to Kitto Landing was used for the first time this year, and is reported to be considerably more economical than the use of teams.

Iva Fern.—Situated on Cultus creek. This mine is owned by J. Mullholland and is being developed under a bond by the Consolidated Mining and Smelting Company, who are now driving a crosscut to intersect the vein at a point below the surface showings.

Good Hope and *Nelson* claims, on Bird creek, are reported to have had development-work done on them by J. B. Baxter and associates. The ore is gold quartz, and the season's work is said to have produced satisfactory results.

The following is a list of shipments made from the district: *Emerald*, 3,176 tons; *Aspen*, 7 tons; *Eureka*, 2,092 tons; *Lost Cabin*, 13 tons; *Monarch*, 170 tons; *Ore Hill*, 37 tons; *Queen*, 14 tons; *Spokane*, 20 tons; *Yankee Girl*, 8,847 tons.

TRAIL CREEK MINING DIVISION.

The thirteenth annual report of the Consolidated Mining and Smelting Company of Canada, Limited, for year ending September 30th, 1918, deals fully with the operation of the smeltery at Trail, and the various mines throughout the district. The outstanding features of the report are as follows:—

The net profit for the year, after deducting taxes to the amount of $81,986, writing off $408,557 for depreciation of plant and equipment, and charging profit and loss account with $219,203 for the development of mining properties, was $867,259. The company will continue to pay dividends at the rate of 10 per cent. per annum. The value of the season's metal product exceeded $10,500,000.

The directors have decided to extend the power-development of the West Kootenay Power and Light Company, and to increase the capacity of the copper-refinery from 20 tons to at least 50 tons a day. It is estimated that these improvements will cost about $1,500,000. An issue of debenture bonds will be created for $3,000,000 to bear interest at 7 per cent.

The solving of the *Sullivan* ore problem makes available many million tons of ore which formerly could not be considered of commercial value, and thus greatly enhances the value of the mine, which is now considered to rank among the leading mines of the world. Headway has been made on the concentration of the low-grade sulphide ores of the Rossland camp, while the cost of mining has been greatly reduced.

A few extracts from the report are here reproduced:—

FROM THE PRESIDENT'S REPORT.

"Your directors have pleasure in presenting the thirteenth annual report of the operations of the company, together with the managing director's report, the financial statement, and the auditor's report for the year ending September 30th, 1918.

"The net profit is $867,259.48 after providing for taxes to the amount of $81,986 and after writing off $408,557.22 for depreciation of plant and equipment and charging profit and loss account with $219,202.33 in development of your properties. Taking into consideration the recent improvements in metallurgical processes, and the enhanced value of the company's mining properties on that account, your directors decided to continue payment of dividends at the rate of 10 per cent. per annum, charging to profit and loss account the deficit of $180,485.52. The balance at credit of profit and loss account now stands at $2,148,122.99.

"Your directors have decided that the power-development of the West Kootenay Power and Light Company, Limited, should be extended and that the copper-refinery should be increased from its present capacity of 20 tons per day to at least 50 tons per day. It is estimated that capital expenditures for these purposes will amount to not less than an additional $1,500,000.

"*Financial Statement.*

"*Liabilities*—

Capital authorized, 600,000 shares, $25 each, $15,000,000.			
Issued and fully paid: 419,098 shares of $25 each			$10,477,450 00
Bank loans and overdrafts			2,809,071 07
Accounts payable			1,386,344 02
Dividends payable October 1st, 1918			261,936 25
Reserves, including provision for claims awaiting adjustment			16,998 71
Profit and loss account—Balance at September 30th, 1917		$2,360,274 73	
Less Provincial income-tax, 1917, paid in 1918		31,666 22	
Total		$2,328,608 51	
Profit for year ending September 30th, 1918	$949,245 48		
Less Dom. income-tax	$27,771 46		
Less Prov. income-tax	22,429 72		
Less mineral-tax	31,784 82		
	81,986 00		
		867,259 48	
		$3,195,867 99	
Less dividends 27, 28, 29, and 30		1,047,745 00	
			2,148,122 99
Total			$17,099,923 04

"*Assets*—

Mines, mineral claims, and shares in other companies—Balance, September 30th, 1917		$7,303,443 60	
Expenditure for year to September 30th, 1918		581,120 82	
			$ 7,884,564 42
Mining, smelting, concentrating, and refining plants—Balance, September 30th, 1917		$4,867,505 25	
Construction for year to September 30th, 1918		130,660 03	
		$4,998,165 21	
Less depreciation		408,557 22	
			4,589,608 06
Ores, metals, and smelter product on hand and in transit—Value of metal contents corrected to market quotations			2,828,415 66
Mine and smelter stores and materials			1,183,183 30
Accounts receivable			542,825 89
Insurance and taxes paid in advance			28,192 86
Cash in banks and on hand—Head office, Toronto		$ 42,148 72	
Sundry cash accounts		984 13	
			43,132 85
Total			$17,099,923 04

"Profit and Loss Account.

"To Smelter product on hand and in transit from smelter to refineries, September 30th, 1917		$ 29,242 95
Ores and metals on hand and in transit to the smelter, September 30th, 1917		2,586,421 22
Customs ore, lead, and bullion purchased		4,120,244 06
Freight on ore from company's mines		190,636 58
Mining, smelting, and general expenses—		
Molly Gibson mine	$ 77,890 51	
Richmond-Eureka mine	243 39	
Highland mine	37,123 34	
No. 1 mine	33,608 66	
St. Eugene mine	339,601 49	
Sullivan mine	339,601 49	
Rossland properties	388,701 19	
No. 7 mine	861 30	
Lucky Thought mine	5,631 22	
Emma mine	47,314 02	
Ottawa mine	4,508 47	
White Bear mine	14,991 11	
San Poil mine	12,225 80	
Tadanac reduction plant	3,279,826 39	
		4,268,219 80
Development expenses—		
Molly Gibson mine	$ 6,348 05	
Highland mine	20,068 77	
Sullivan mine	14,335 93	
Rossland properties	145,744 57	
Emma mine	26,093 38	
Ottawa mine	6,611 63	
		219,202 33
Depreciation		408,557 22
Directors' fees		8,800 00
Sundry items written off, including bad debts		4,415 80
Balance—profit		949,245 48
Total		$12,784,985 44

"By Sales of smelter product, ore, etc.	$ 9,780,564 64
Ores, metals, and smelter product on hand and in transit—Value of metal contents corrected to market quotations	2,828,415 66
Rents and sundry revenues	16,005 14
West Kootenay Power and Light Company, Limited, dividends	160,000 00
Total	$12,784,985 44

FROM THE MANAGING DIRECTOR'S REPORT.

"Operations were conducted under very difficult conditions. The first part of the year was unprofitable because of the strike, which not only caused direct loss, but also interrupted production. A strike is always expensive, but weak submission to unreasonable demands is ruinous.

"The latter part of the year produced much better results—largely because of improved metallurgical practice. Materials all tended to appreciate during the year. Labour was more expensive and inefficient. Though at times the metal markets were unstable, all the metals produced were sold.

"'Following the armistice, the demand for metals for munitions purposes ceased. It may be worth while to record that from the beginning of the war down to the end of the fiscal year the company supplied the Imperial Ministry with 22,356 tons of zinc, 39,606 tons of lead, and 6,831 tons of copper. The average prices obtained for these metals were:—

Zinc	12.43 cents per pound.
Lead	7.96 cents per pound.
Copper	29.68 cents per pound.

"The saving to the Imperial Ministry through the supplying of high-grade electrolytic zinc at the price named amounts to a very large sum. The average Canadian market price for lead during the period was 8.98 cents per pound.

"The appropriation of nearly all construction material to war purposes affected very seriously the normal commercial demand for lead. The Imperial Munitions Board took the position that they could pay little, if any, more for their lead requirements than these could be secured for from foreigners, although Canadian production costs are necessarily higher because of the heavy duties paid on all equipment and supplies and for other reasons.

"In regard to copper, while the Imperial Ministry made a special allowance to cover the cost of refining copper on a small scale, the price obtained was still below the Canadian market price.

"Shareholders may rest assured, therefore, that the company has made at least a moderate 'money' contribution towards the prosecution of the war, but the greatest and finest gift was that made by the employees. In spite of the fact that a large percentage of the men were married, and many were foreigners, nearly 15 per cent. of the employees enlisted for overseas service. Practically 80 per cent. of the unmarried men of military age in the staff enlisted without waiting for conscription. Many of the finest of these made the supreme sacrifice. Most of them were decorated for deeds of valour, and not one of them has failed to make good in the face of the Hun.

"The company's direct contribution for Red Cross and patriotic purposes was over $30,000.

"At the same time, it must be realized that war activities have resulted in the establishment on a firm footing in Canada of industries engaged in the production of high-grade zinc and refined copper. The fabrication of these metals is bound to follow in due course.

"Since the cessation of hostilities the normal commercial demand for metals has not asserted itself. There may be a temporary lull in actual consumption, but no apprehension is felt as to markets and prices when usual conditions prevail.

"The Canadian consumption of copper, lead, and zinc prior to the war was in excess of the capacity of the company's plant.

"After all, the mines of the company and their ore reserves constitute the real assets. The control of the West Kootenay Power and Light Company is next in importance, as through it an adequate supply of electrical energy is assured, and at a reasonable cost.

"The *Sullivan* mine has been referred to as the great property of the company, but there are other mineral locations in course of development which promise as well as the *Sullivan* did at the same stage.

"Temporarily, the Rossland mines are unprofitable through high operating costs—the fixed price of gold and its reduced purchasing power. When normal conditions return, as they are bound to do, Rossland will resume its place as one of the foremost metal-producers of the country.

"The $700,000 advance from the Imperial Munitions Board towards the extension of the zinc plant was repaid in full during the year.

From the Assistant General Manager's Report.

"*The Copper-smelting Plant.*—The year's operations were very expensive owing to intermittent operation, shortage of tonnage caused by the reduced purchasing power of gold, making mining operations impossible, and heavy overhead expenditure. The year's work was conducted with a view to holding the loss down as low as possible. The metallurgical work showed improved gold recoveries.

"*Lead-smelting Plant.*—Operations continued to be unprofitable during the first part of the year. This was owing mainly to the fact that the metal recoveries were not as high as the quantities paid for. The metal losses were smaller than they had been for many years, but the

prices paid for the metal lost were extremely high. In former years each unit of lead cost the company from 40 to 50 cents, while in 1917-18 the same amount of metal cost as much as $2.20.

"In the latter part of the year much improvement was made in extracting the values from the lead-smoke. The percentage of extraction has already shown a substantial increase, although the installation to take full advantage of the recent discoveries is not yet completed.

"For many years the rates charged for smelting customs lead ores were much too low to cover the metallurgical losses and operating expenses. On February 1st, 1918, these rates were advanced to cover expenses and make a small profit.

"*Lead and Copper Refineries.*—Both of these plants worked on small tonnages most of the year and were handicapped on that account. The lead-refinery showed a very decided reduction in costs, especially in the last months of the year, and proved that for small-tonnage plants the Betts process can compare very favourably with the Parkes process.

"The acquisition of a fluorspar-mine will make a further reduction in cost—fluorspar having formerly been purchased in the east.

"In the copper-refinery the costs have been about as low as could be expected, with the exception of the melting and casting of refined copper.

"The great variety of shapes required by munitions orders for the small tonnage handled, and the difficulty in securing competent labour to do this work, made it advisable to have the copper cast in transit at Great Falls, Montana. In the meantime the melting plant is being enlarged and equipped to handle commercial orders.

"*Acid Plant.*—The sulphuric and hydrofluosilicic acid plants were successfully operated all year. Several improvements were made in the hydrofluosilicic acid plant, and there is now no difficulty in making sufficient acid to operate the entire plant.

"*The Zinc Plant and Concentrator.*—Many very important changes have been made. At the beginning of the year and prior to that date the cost of producing zinc was so high that it would have been impossible to keep the plant running when zinc dropped to its normal price. The plant was thoroughly reorganized and very large reductions made in costs.

"Large-scale experimental work proved that further improvements could be made, more particularly in concentration. These are now being installed in the plant, and when completed will reduce the cost of producing zinc very much further, and will also enable the lead and silver of the *Sullivan* ore to be reclaimed.

"The whole process has been worked out and designed for the complex ores of the *Sullivan* mine. It is possible, though, that other ores may be treated in the same way, but sufficient work has not yet been done to say which ores may and which ores may not be so treated.

"*Sullivan Problem solved.*—The year's developments and improvements have demonstrated that at last the problem of handling the complex *Sullivan* zinc ore has been solved. With a plant operating of from 1,000 to 2,000 tons of this ore per day, there should be no trouble in producing zinc and lead at a profit on any market that has existed in recent years, provided that the cost of labour and supplies falls with the price of these metals. This successful solution of the problem makes available many millions of tons of mixed ore in the *Sullivan* mine which formerly could not be considered commercial ore, although very high in metal content.

"While all of the present plant will be used, quite substantial expenditures on capital account must be made for the necessary extensions to treat the large tonnage above mentioned; besides, it will take considerable time to do this work.

"The research department, which has become a very important part of the organization, worked on the concentration of the ores in our own and other mines; the metallurgical-smoke problem; the manufacture of different chemicals from by-products; and the solution of the various difficulties in our different processes. As already stated, much has been accomplished in connection with the treatment of *Sullivan* ore.

"*Encouraging at Rossland.*—Some headway has also been made on the concentration of the low sulphide ores from Rossland. These results are especially encouraging, as the portion of the Rossland ores most amenable to concentration is that which is the most difficult and expensive to smelt.

"Great strides have also been made in reducing the costs and increasing the efficiency in the mines, though the full force of these will not be felt till working conditions become normal again.

From the Manager of Mines' Report.

"I beg to submit the following report on the operations of the various mines of the company, with accompanying tabulated results in development and production:—

"*Production*—	Sept. 30th, 1917-18. Tons.	1894 to Date. Tons.
Centre Star-War Eagle, gold-copper ore	49,298	2,660,441
Concentrates	.....	9
Le Roi, gold-copper ore	54,918	2,062,544
Le Roi, concentrates	.....	612
White Bear, gold-copper ore	2,158	2,882
Sullivan, lead ore	22,673	.....
Sullivan, first-class zinc ore	71,048	.....
Sullivan, second-class zinc ore	7,563	.....
Sullivan, pyrites	3,474	595,559
St. Eugene, company lead ore	924	.....
St. Eugene, leasing company lead ore	267	1,022,127
Molly Gibson, silver-lead ore	1,320	.....
*Molly Gibson, silver-lead concentrates	192	7,357
*No. 1, silver ore	5,185	23,312
*Highland, lead-silver ore	283	4,602
Highland, lead-silver concentrates	414	4,727
*Maestro, lead-silver ore	.....	463
Maestro, lead-silver concentrates	.....	88
*Ottawa, silver ore	48	689
Lucky Thought, lead-silver ore	.....	675
Lucky Thought, silver-zinc ore	378	1,141
*Richmond-Eureka, lead-silver ore	37	14,734
*Silver King, silver-copper ore	.....	17,238
Emma, copper ore	24,968	201,050
Phoenix Amalgamated, copper ore	.....	2,493
No. 7, siliceous gold-silver ore	.....	7,388
*Ben Hur, siliceous gold-silver ore	.....	12,075
San Poil, siliceous gold-silver ore	1,491	.....
Blue Grouse, copper ore	157	.....

Note.—Production given above includes that of previous owners.

"*Development*—	Total Feet.	Diamond-drilling.
Centre Star-War Eagle	4,274.0	4,833.1
Le Roi	2,645.0	4,641.4
White Bear	634.0	773.5
St. Eugene	61.0	.....
Sullivan	2,539.0	1,774.7
Molly Gibson	366.0	.....
No. 1	553.0	.....
Highland	2,426.3	.....
Ottawa	490.0	.....
Lucky Thought	148.0	.....
Emma	1,817.2	693.4
Richmond-Eureka	128.0	.....
Silver King	.....	5,267.6
Coast Copper Co.	.....	867.0
San Poil	.....	1,831.0
Rock Candy	40.0	492.0
Blue Grouse	.....	.....

* Since company acquired property only. Previous records not available.

"Making the total to date as follows:—

	Feet.	Miles.
Centre Star-War Eagle	216,127.5	40.93
Le Roi	92,926.0	17.60
White Bear	8,956.0	1.70
Sullivan	40,202.5	7.65
St. Eugene	105,971.5	20.04
Molly Gibson	11,108.0	2.10
Richmond-Eureka	9,674.0	1.80
No. 7	5,934.0	1.12
Phoenix Amalgamated	2,581.0	.49
No. 1	8,944.7	1.70
Highland	17,069.2	3.23
Ottawa	11,387.0	2.15
Silver King	20,462.0	3.88
Lucky Thought	3,490.0	.66
Emma	5,894.7	1.11
Coast Copper Co.	2,961.7	.56
Rock Candy	55.0	.....

"*Rossland Output irregular.*—About the same tonnage was shipped from the Rossland mines as in the previous year; shipments, however, were very irregular, but attained considerable proportions from January to April, when an unsuccessful attempt was made to cope with steadily increasing operating costs at mines and smelter by handling fairly large but certain definite tonnages with maximum output of ore high in iron from the *Emma*.

"Development was less than that of last year by nearly 4,000 feet, and for the most part was confined to extensions of trunk-line drifts and crosscuts in new territory. Promising veins have been disclosed in the work east from the *Centre Star* sixth and seventh levels and west from the *Le Roi* 1,650 and *White Bear* workings, but insufficient work has been done on them to permit of any estimate of tonnages. A crosscut is being driven to explore ground optioned during the year. Some additional tonnages have been made available by work north on the *Le Roi* tenth level under the *Josie* plane, on the *War Eagle* twelfth and thirteenth and *Centre Star* sixth levels.

"In the *White Bear*, development-work consisted in extensions of drifts from the old workings, in some instances into *Le Roi* ground, and in diamond-drilling. Some new ore was opened up on the eighth level. The stopes on the eighth and tenth levels were extended.

"Steadily increasing smelter costs on Rossland ore have stimulated experiments along other lines of treatment with encouraging results, which, if defintely established, will make available a much larger tonnage than is included in our estimate of present ore reserves."

On January 20th, 1918, the Consolidated Mining and Smelting Company introduced Schedule B of treatment charges for silver-lead-zinc ores, which did not meet with entire satisfaction from the mine-owners, so at the instigation of the associated Boards of Trade of south-eastern British Columbia a committee was appointed to investigate and report on the smelter charges. The committee, composed of S. S. Fowler, Ivan DeLashmutt, and J. Anderson, refused to act until they received the necessary authority from the Federal Government at Ottawa; this was granted and the first meeting was called in October, but on account of the influenza epidemic was postponed until January 21st, 1919. The Resident Engineer for the district was appointed to attend this and subsequent meeetings, in order to report all the facts and evidence to the Lieutenant-Governor in Council.

The following is a copy of Schedule B:—

"SCHEDULE B—LEAD ORES.

"*Payments.*

"*Gold.*—Pay for 95 per cent. of the assay at $20 per oz. No pay for gold unless 0.05 oz. per dry ton or over.

"*Silver and Lead.*—Payments for silver and lead will be based upon the zinc contents of the ore on the following schedule:—

"No ore containing more than 25 per cent. zinc will be accepted under this schedule.

"*Zinc Contents*—	Silver Payment.	Lead Payment.
4 per cent. or under	95 per cent.	90 per cent.
Over 4 per cent. and including 5 per cent.	94½ „	89 „
„ 5 „ „ 6 „	94 „	88 „
„ 6 „ „ 7 „	93½ „	87 „
„ 7 „ „ 8 „	93 „	86 „
„ 8 „ „ 9 „	92½ „	85 „
„ 9 „ „ 10 „	92 „	84 „
„ 10 „ „ 11 „	91½ „	83 „
„ 11 „ „ 12 „	91 „	82 „
„ 12 „ „ 13 „	90½ „	81 „
„ 13 „ „ 14 „	90 „	80 „
„ 14 „ „ 15 „	89½ „	79 „
„ 15 „ „ 16 „	89 „	78 „
„ 16 „ „ 17 „	88½ „	77 „
„ 17 „ „ 18 „	88 „	76 „
„ 18 „ „ 19 „	87½ „	75 „
„ 19 „ „ 20 „	87 „	74 „
„ 20 „ „ 21 „	86½ „	73 „
„ 21 „ „ 22 „	86 „	72 „
„ 22 „ „ 23 „	85½ „	71 „
„ 23 „ „ 24 „	85 „	70 „
„ 24 „ „ 25 „	84½ „	69 „

"*Silver* will be paid for to the extent shown by the above schedule on the fire assay at the average of the *Engineering and Mining Journal*, New York, quotations for the second calendar month succeeding the date of sampling at Tadanac, B.C. In no case will the deduction from the silver assay be less than 0.5 oz. per dry ton.

"*Lead* will be determined by the wet method of analysis, from which 1½ units will be deducted to arrive at the dry-lead assay. Lead will be accounted for to the extent shown by the above schedule: Provided, however, that in no case will the deduction from the said dry-lead assay be less than 1 unit or 20 lb. per dry ton. Settlement for lead will be made on the basis of our circular of November 5th, 1917, as modified by our circular of January 18th, 1918.

"*Deductions.*

"*Smelting.*—Per dry ton of material $7.50 as a base rate, which will be modified in accordance with the following formula:—

"(1.) Add to the base rate per ton 9 times the units of zinc shown by analysis at 9 cents per unit.

"(2.) Deduct from this result the total units of silica, iron, manganese, lime, and magnesia at 9 cents per unit:

"Provided that in no case said base rate be reduced more than $3.50 per ton as the net result of the additions and deductions:

"Provided also that in making the above computation iron, silica, and lime of 1 per cent. or under and manganese and magnesia if 3 per cent. or under will be disregarded.

"*Sulphur.*—A charge will be made in addition to the above for all sulphur contained at 50 cents per unit per dry ton of material, provided that such charge shall not exceed $4 per ton in any case.

"*Moisture.*—A minimum moisture deduction of ¼ per cent. will be made. The following penalty for moisture will apply to fine concentrates and clayey ore only: If over 5 per cent. charge for contents at 10 cents per dry ton per unit.

"*Flotation Concentrates.*—Flotation concentrates will be charged $1 extra per dry ton.

"*Size.*—Coarse and fine concentrates and ores must be shipped separately; if over 30 per cent. will pass through a ¼-inch screen; otherwise an extra charge of 50 cents per ton will be made.

"*Sampling.*—If the shipment is less than a car-lot or contains more than one lot per car, a deduction will be made for extra sampling, assaying, etc., of $10 per lot.

"*Weights and Samples* to be used in settlement shall be those made at the smelter.

"*Representation.*—Shippers are expected to notify us as to who will represent them while their shipments are being weighed and sampled. Failure to do so will be construed as meaning that the smelter will have authority to appoint one of the local mine representatives at the shipper's expense, unless the shipper notifies us that a representative is not required. All shipments will be released for smelting as soon as sampled.

"*Assays.*—Shippers will supply the smelter with their assays on smelter pulps shortly after sampling. In case of difference in assays requiring it, the umpire pulp will be referred to an umpire mutually agreeable. The party whose result is farthest from the umpire's result will pay his fee.

"*Settlement.*—Advances on preliminary settlements will be made as set out in our circular of November 5th, 1917, as modified by our circular of January 18th, 1918. The final settlement for the silver will be adjusted between the parties shortly after the close of the second calendar month succeeding the date of sampling when quotations are available. The final settlement for the lead will be adjusted whenever the pooling arrangement will permit.

"If the present price of coke is changed the above rates will be increased or decreased 25 per cent. of whatever price per ton coke costs, more or less.

"If our present price of labour is changed the above rates will be increased or decreased 1½ cents per ton for each 1 cent change per shift for labour.

"The above rates are subject to change without notice."

Le Roi No. 2.

This is the only producing mine in the Rossland camp which is not operated by the Consolidated Mining and Smelting Company, Limited. The property is owned and operated by the Le Roi No. 2 Company, Limited, of London, England. Ernest Levy is resident manager. The year's shipments show an increase over those of last year of nearly 3,000 tons. The ore is gold-copper and similar in character to that of the *Centre Star-Le Roi* group.

Velvet.—Exploratory work was carried on by the Granby Consolidated Mining, Smelting, and Producing Company during the early part of the year, but, according to reports, was recently discontinued.

Mountain Chief.

This property, consisting of four claims and a fraction—the *Mountain Chief*, *Morning Glory*, *Calgary*, *Sunset*, and *Morning Glory Fraction*—was operated during the year by M. McDaniels, O. Wheeler, and associates. Early in 1918 the Mountain Chief Mining Company was incorporated with a view to acquiring the property and securing the necessary capital to develop and operate the mine on a larger scale than heretofore. The officers of the company are: J. W. Evans, president; A. D. Nash, managing director; Charles F. Blacha, of Walla Walla, director; W. A. Gordon, of Revelstoke, director; J. H. Lawrence, secretary-treasurer; C. R. Hamilton, solicitor.

Surveys are now being made for the right-of-way for a 2-bucket tram-line from the mine to Dog Creek valley, a distance of approximately 2,000 feet, while plans are prepared for the systematic development and mining of the deposit. The property is conveniently situated to transportation facilities, the distance from Renata, on Lower Arrow lake, being about three miles, while the elevation above the lake is 1,100 feet. Ore can be hauled from the lower terminal of the proposed tram to the lake-shore for 50 cents a ton.

Some years ago a 30-foot shaft was sunk and various open-cuts made in an endeavour to locate a commercial body of ore. Unfortunately the results obtained were not very encouraging and the property remained idle until last year, when further work was done. The old workings apparently were too far to the north of the main ore-body, which was developed during the year by M. McDaniels, under whose supervision some 600 tons was shipped to the Trail smelter, and at the time the property was inspected there was about 600 tons of positive ore available.

The development this year consisted of stripping and open-cut work along the trend of the ore-body in a northerly and southerly direction. This disclosed an ore-body having an average width of 5 feet and a length of about 100 feet. The ore as yet developed lies near the surface and resembles a blanket deposit, but no work has been done to disprove this fact, and present geological conditions would indicate that the true foot-wall has not yet been reached.

The ore, which occurs in a highly metamorphosed and siliceous limestone near the contact of an intrusive granitic mass, forms a replacement deposit and probably owes its origin to pneumatolytic conditions due to the adjoining intrusive rocks. The ore-minerals are chalcopyrite,

bornite, melachite, and azurite, with which is associated iron pyrites. The gangue runs high in silica. The average metallic contents of the unsorted ore, according to a previous shipment, is as follows: Gold, trace; silver, 2.5 oz.; copper, 3.5 per cent. I would consider it a prospect which has good possibilities.

Peggy and Rickward.—These two claims adjoin the *Mountain Chief* group to the south, and have had a considerable amount of prospecting done on them, which has been chiefly confined to open-cut work. Although there are copper indications, no ore in commercial quantities has as yet been developed.

NORTH-EAST KOOTENAY DISTRICT.

GOLDEN AND WINDERMERE MINING DIVISIONS.

REPORT BY JOHN BULMAN, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report of the North-east Kootenay District, embracing the Windermere and Golden Mining Divisions.

Although only a very limited number of mines have been shipping during the year, there has been an increase of ore shipped out of the district, principally from the *Couverapee* and *Monarch* claims on Mount Stephen and the *Paradise* mine on Toby creek.

I enclose report from the Mining Recorder at Wilmer, which covers nearly all the principal mines in the Windermere Mining Division. The following is my report on the *Monarch*, *Couverapee*, and the *Giant* mines, which are situated in the Golden Mining Division:—

GOLDEN MINING DIVISION.

Monarch. Situated on Mount Stephen, Field. This mine has the distinction of being one of the first mining claims located in British Columbia and has produced approximately $1,250,000 in lead and silver. The zinc content, formerly considered an objectionable feature, has been impounded on the banks of the Kicking Horse river, immediately below the company's mill. Assay results from these tailings give 16 per cent. zinc, 3 per cent. lead, and 3 oz. silver to the ton.

The ore-deposits are clearly "bedded veins," but are local fractures traversing the formation some two miles in length. Commercial bodies of ore usually occur along these fractures and into the formation some 300 feet on either side, and to a known length of 400 feet, as demonstrated by the *Monarch* mine.

The metals contained in the ores are lead, zinc, and silver. The content varies from 8 to 65 per cent. lead, 3 to 12 oz. silver, 4 to 22 per cent. zinc, and 0 to 5 per cent. iron. Considerable lead has been shipped in its crude form, but is largely concentrating. Recent sampling of the *Couverapee* mine, immediately adjoining the *Monarch* on the westerly end line, gave 16.8 per cent. lead, 4 oz. silver, and 3 per cent. zinc, with bands of lead varying from 2 to 5 feet of 55-per-cent. lead.

The company has a mill situated 1,600 feet from the mine, connecting the mine with an aerial tramway. This mill is not of the type adopted to treatment of such ores, and in consequence much of the values goes to the "tails."

Couverapee. Situated on Mount Stephen, Field. This mine, a new location, being operated but three years, is giving splendid returns and exhibits permanency of values, with the same conditions for operating as the *Monarch;* in fact, it is operating through the *Monarch* property and mill. This mine was recently taken over by Calgary investors, who expect to install an entire new plant of a much larger and modern type.

The development consists of a chamber 90 x 60 x 20 feet, making an extraction of some 6,000 tons, from which over 600 tons of concentrates has been shipped.

Known ore has been sampled for over 300 feet above the present workings, which should be connected by diamond-drill holes, giving the operators knowledge of ground values and methods for future operations.

The *Monarch* mine has been idle for some time, but is now held by bond and lease. The *Couverapee* mine is in constant operation.

SPILLIMACHEEN DISTRICT.

Giant.—Situated on the Spillimacheen river. There is quite a large body of low-grade ore, but owing to the absence of Captain Armstrong, one of the owners, being away serving his country on the Tigris river, there has been no development since the war broke out.

Looking Across Boulder Cr. from Sitting Bull Cabin, Windermere M.D.

Mount Nelson from Sitting Bull Cabin, Windermere M.D.

Office Statistics—Golden Mining Division.

Revenue.

Free miners' certificates (special) (1)	$ .15 00
Free miners' certificates (ordinary) (114)	608 75
Free miners' certificates (company) (1)	27 50
Mineral claims recorded (27).	
Assessments recorded (36).	
Bills of sale and agreements (16)	321 30
Notices to group (4)	1 00
Lease fees (5)	125 00
Ore-tax	2,950 23
Acreage-tax	1,698 62
Total	$5,747 40

WINDERMERE MINING DIVISION.

Report by E. M. Sandilands, Mining Recorder.

I have the honour to submit my mining report for the year 1918 on operations in the Windermere Mining Division.

Paradise. During 1918 active work has been carried on at this property with a monthly average of some thirty to thirty-five men at the mine and from six to ten men employed in the transportation of ore. The new "Cut-off" road from the mine to Invermere has been improved and shortened, so the transportation of ore has been greatly facilitated. The raise from No. 4 tunnel to No. 3 tunnel has been put through, and now all the ore comes out through No. 4 tunnel. Several improvements in the tramway and buildings at the mine have been accomplished this past year. The class of ore shipped is a sand carbonate, and its values run from 30 oz. in silver to 35 per cent. in lead. Over 2,700 tons of ore has been shipped to the Trail smelter. All the ore is now shipped from the bunkers at Invermere.

Mabel R., Relief, and Isaac.—These properties have been idle the past year.

Lead Queen. This property, situated on Frances creek and owned by Thos. Brown and associates, was bonded in the fall to P. Denhart, of Seattle, and work on the property carried on with a force of men varying from eight to ten. Unfortunately snowslides have stopped operations until the spring. Some 80 tons of ore has been hauled to the railway at Brisco. Work will recommence in the spring when the danger of snowslides is over.

Sitting Bull and Delos. These properties are situated up Horse Thief creek, on Boulder creek. The *Sitting Bull* is owned and operated by Mr. Wonn, of Seattle, with E. D. Smith in charge as superintendent. The *Delos* is also owned by some of the same people, but called the Trojan Mining Company. During the summer considerable work was done on these properties and a new wagon-road commenced from the main road on the Horse Thief, leaving the main road at about the 7- and 8-Mile posts. A wagon-road has been built to the *Delos*, between four and five miles from the main road, and a rawhide trail built to the *Sitting Bull*, a distance of some three miles farther. It is intended to continue the wagon-road from the *Delos* to the *Sitting Bull*. Ore is now being hauled to the railway at Athalmer for shipment to the Trail smelter. The company intends to put in a compressor with which to drive a crosscut tunnel. The ore is a steel galena and of fairly good grade.

Blue Grouse and Bald Eagle.—These claims are situated across the summit from the Paradise basin on Boulder creek and have been worked all summer by Burman and partners. Considerable work has been done and some ore taken out which they expect to ship this winter. The ore is of a very good grade of galena.

Hot Punch.—This property is owned by Stoddart & Parry and is situated on the North fork of Toby creek. Work has been going on during the fall and three or four men working. About 45 tons of ore has been hauled to the railway for shipment. The ore is of a fairly good grade.

During 1918 quite an amount of prospecting-work has been done with fair results, and more assessments recorded than the previous year. Also the number of miners' licences sold and claims recorded exceeded those of 1917.

OFFICE STATISTICS—WINDERMERE MINING DIVISION.

Free miners' certificates sold (ordinary)	86
Free miners' certificates sold (special)	1
Claims recorded (quartz)	54
Claims recorded (placer)	23
Certificates of work issued	61
Certificates of improvements	*Nil*
Bills of sale, agreements, etc.	28

SOUTH-EAST KOOTENAY DISTRICT.

FORT STEELE MINING DIVISION.

Report by N. A. Wallinger, Gold Commissioner.

I have the honour to submit a report on the progress of mining in the Fort Steele Mining Division for the year 1918.

The following table shows approximately the number of mineral claims held during each year since 1899:—

Year.	Held under Crown Grant or Certificate of Improvement.	Certificate of Work.	New Locations.
1899	37	718	729
1900	71	704	470
1901	104	642	455
1902	117	451	253
1903	142	335	200
1904	167	260	169
1905	189	193	181
1906	241	235	160
1907	254	160	115
1908	264	150	100
1909	280	154	116
1910	294	161	179
1911	307	167	96
1912	316	143	145
1913	319	139	104
1914	345	189	179
1915	350	203	114
1916	353	133	56
1917	367	120	105
1918	380	122	87

Although the year's results were disappointing in some respects, there is no doubt that the investigations of visiting engineers were favourable, and several bonds are in process of completion, whereby much development is proposed for 1919.

The withdrawal of the Federal Mining and Smelting Company from the district was the chief disappointing feature, presumably due to the failure of the diamond-drilling operations on the North Star hill and *Stemwinder* properties to show up any extension of the known ore-bodies.

After the Federal Mining and Smelting Company had abandoned the option on the *North Star* mine the property was leased by Thompson & Brander, who have shipped over 2,450 tons of ore to Trail, and it is the intention of the lessees under their five-year tenure to operate on a more extensive scale during 1919. Up to the present the main supply of ore shipped has come from the old dumps, from which a very fair profit was made.

Two or three properties in the St. Mary district were under examination, and arrangements have been made whereby the large body of low-grade copper ore on Whitefish creek is to be prospected and developed. This is an important move for the district and much depends on the success. This property, belonging to the Evans Bros., has never been thoroughly prospected, as it is far too extensive for the work of ordinary prospectors.

The properties on Alki creek also came in for examination, and an option was given on the *Blue Peter* group; this property carries copper associated with pyrrhotite and mispickel in a strong, well-defined quartz ledge in the hornblende quartzites of the Aldridge formation. It is owned by Lieut.-Colonel Pollen.

The *Park* group, which had ceased working owing to the increased cost of operation, is to start again immediately the snow is off; what work was done in 1918 was not very satisfactory, but was of too small an amount to determine anything.

Perry creek showed some improvement as far as placer-mining was concerned. The Wild Horse Creek Placer Mining Company, which has bought out the old Perry Creek Hydraulic, did considerable work fixing up the big flume, putting in supplies, lumber, etc., and making ready for an early start this spring.

Placer-mining appears to be coming into some favour again, as, besides Perry creek, Wild Horse is to be tried again by a Seattle company which has taken up six new leases and obtained an option on the existing leases and plant, with the intention of thoroughly exploiting the creek by new methods.

The Moyie placer is also to come in for prospecting at the falls; it is a good many years since anything of any importance was done here, although this locality received a lot of attention from the old placer-miners.

As far as gold-quartz mining was concerned, nothing was done; Perry creek, being essentially a low-grade free-milling gold-quartz camp, does not appeal to capital at present on account of the increased cost of operation.

The Consolidated Mining and Smelting Company is still making records in the ore-extraction from the *Sullivan* mine; the work on the main adit-tunnel was resumed early in November and is being pushed forward with a full force of men, and is now in over 8,000 feet. Pretty nearly 135,000 tons of ore was shipped from this mine last year, the preponderance being zinc ore. It is the intention of the company to make, in the near future, still further improvements and developments for the more economical handling of the ore and the comfort of employees. The extent of the ore reserves fully warrants a large outlay to facilitate the handling of the immense annual tonnage contemplated.

The *St. Eugene* is still shipping a little ore, both by the lessees and also the Consolidated Mining and Smelting Company, but none of the other properties in this camp have broken into the shipping-list, although the *Hawes* group, the *Guindon* group, and the *Aurora* have all reported ore in sight.

It is the intention of the local Board of Trade, with the assistance of the Provincial Government, to have a comprehensive collection of ores from this district displayed in a conspicuous place; this collection is to be supplemented with samples of lesser-known ores and minerals for the use and benefit of the prospectors.

The depreciation in the value of lead will necessarily have some effect on the demand for galena properties, but this is practically offset by the increased price of silver; the lead question, however, appears to be somewhat disquieting, as the market value is too fluctuating to establish any confidence.

In conclusion, I would point out that the general interest in mining has been maintained and the receipts in excess of the former year.

OFFICE STATISTICS—FORT STEELE MINING DIVISION.

Mineral claims recorded ("B")	87
Certificates of work ("E")	122
Certificates of improvement issued ("G")	13
Conveyances and other documents of title (bills of sale)	28
Abandonments	..
Partnership agreements	1
Gold Commissioner's permits	5
Documents filed	9
Affidavits filed	159
Mining leases issued	5
Free miners' certificates (ordinary)	208
Free miners' certificates (company)	3
Free miners' certificates (special)	..
Crown grants issued	13

Revenue.

Free miners' certificates	$1,256 25
Mining receipts	1,209 25

NORTH-WEST KOOTENAY DISTRICT.

REVELSTOKE AND LARDEAU MINING DIVISIONS.

Report by Arthur Johnston, Gold Commissioner.

I have the honour to submit herewith a report on the mining conditions within the Revelstoke and Lardeau Mining Divisions for the year ending December 31st, 1918.

My forecast, in the Annual Report for 1917, of a year of very promising activity in these Divisions unfortunately did not materialize to the extent that we had anticipated.

Big Bend District.

The Mastodon Mining Company, which is operating on LaForme creek, twenty miles north of Revelstoke, continued the work of developing its properties throughout the season with a crew of twelve men. The properties extend over the summit from LaForme creek to the slope of Carnes creek. The season's work under the direction of the manager of the company, J. W. Evans, proved most encouraging. On the Carnes Creek slope a great deal of open-cut work has been done on the veins, all exposing ore. The company has also drifted 70 feet on one of these. When the snow came this fall the crew moved to the shaft at the lower vein, which has been sunk 110 feet to the 143-foot level. The high-grade zinc is giving way and is now showing galena. On the 110-foot level a drift 80 feet long was made and crosscut at three points, disclosing high-grade zinc ore. Some 20 tons of ore has been moved to the end of the wagon-road, sixteen miles north of Revelstoke, which could have been shipped to the smelter had it not been for slides which occurred on the road this fall. This was the only property working in the Big Bend, although the individual miner and the prospector completed the annual assessments on their claims.

Placer-mining was at a practical standstill. Remillard and associates, who have under lease some placer-ground on French creek, devoted the entire summer in constructing a flume for the purpose of bringing sufficient water from French creek on to the ground. This flume is about completed and the forthcoming season should see active mining. French creek was a big producer in the early sixties.

Albert Canyon and Illecillewaet Districts.

These districts were the most active during the season just past. A number of men prominent in the mining business made visits to the camps.

The Silver Creek mines, known locally as the *Woolsey* group, is located up Silver creek, about six miles from the Canadian Pacific Railway at Albert Canyon. This property is owned by Calgary capitalists and is managed by David Woolsey. The operations this season were devoted chiefly to the erection of cabins and mine buildings and the construction of a trail from the railroad to the mines. This year plans are out for extensive development of the strong leads that are known to traverse the property.

Adjoining this group, Sandberg & Hedstrom have located two claims that have excellent showings of high-grade ore exposed on the surface. No work has been done on the ground and the permanency of the ore-bodies is not as yet determined.

Lanark.

W. B. Dornberg, manager of the *Lanark* mines, continued extensive improvements to the mine equipment this year. A 250-horse-power hydro-electric plant was constructed to run the concentrator and compressor; the former was installed two years ago, whilst the latter was added to the equipment this season. Development-work consisted chiefly in opening up the new ore-bodies which, by systematic prospecting under the direction of Mr. Dornberg, were recently located and defined. The new lead discovered on the *Lanark* and which was prospected thoroughly has given considerable value to the company's holdings. It has proven to be an entirely new ore-bearing zone and has no connection with the old *Lanark* leads, from which hundreds of tons of high-grade silver-lead ores have been extracted and smelted, and which still hold extensive deposits now being prospected and blocked out for future tonnage. Twelve miners were employed at actual mining, and a big crew of men was engaged in erecting the new equipment during the summer months.

In the Cariboo-Mountain Creek district a number of claims were located and recorded during the summer and fall. This district is just east of the *Lanark* properties above Illecillewaet, about twenty-five miles east of Revelstoke. The leads located are all well defined and the ore samples brought into the city are high-grade silver-lead and copper-gold.

LARDEAU MINING DIVISION.

Mining operations in this Division show a further decrease over that of last year. Like all the mining districts in North Kootenay, it felt the effect of war conditions, which of necessity curtailed expenditure in the exploitation of the less-developed mines; there being practically no capital for the development of prospects.

The Multiplex Mining Company, which has been the largest operator in the Camborne camp during the past few years, ceased active work early in the year owing to conditions which made it impossible to get sufficient help for the economic working of the property. Up to date this company has expended upwards of $25,000 in actual mine-development, and the property is now in a good position for future operations. It is understood that the finances of the company are in good shape for this year and a vigorous development policy is planned. It is understood it is the company's intention to construct a concentrator this year to handle the output. It is likely to be a customs concentrator, and will be of great benefit to the small mine-owner who desires to concentrate his ore and thus save transportation and procure the maximum of smelter returns.

The *Beatrice* was bonded last fall to a company represented at Vancouver. It is expected that the bondholders will be on the ground as soon as the season opens up, with a view to opening up again this famous old shipper of silver-lead-zinc ores.

The *Berniere*, *Nelson*, and *Goldfinch*, all free-milling gold properties, were inspected late last fall by Mr. Wilde, a mining engineer representing Los Angeles capitalists, accompanied by J. A. Darragh, one of the oldest operators in the Camborne camp. Mr. Wilde will return this spring to the camp for a further examination of these properties, as well as others in the neighbourhood.

A deal is now pending for the purchase of the *Scout* and *Big Showing* groups, which are owned by George Goldsmith and associates, of Cranbrook.

The *Eva* and *Oyster-Criterion* gold properties, which are the most highly developed in the district, have remained idle for some time. These properties were inspected last summer by mining men from Vancouver, but there is no evidence of their intentions in respect to these mines.

There are a number of excellent prospects located in this Division that are well worthy of the inspection and consideration of those seeking a field for future mining enterprise.

REVELSTOKE MINING DIVISION.

REPORT OF JOHN LEE, MINING RECORDER.

I have the honour to submit herewith the annual mining report and office statistics of the Revelstoke Mining Division for the year ending December 31st, 1918.

The past year has been exceptionally quiet in the mining industry of this Division. The scarcity of labour owing to war is responsible for the inactivity affecting mining as well as other lines of industry, and in consequence retarded prospecting. However, with peace conditions, there is no doubt men will again take to the hills and a revival is fully anticipated.

OFFICE STATISTICS—REVELSTOKE MINING DIVISION.

Free miners' certificates	148
Free miners' certificates (company)	1
Locations recorded	67
Certificates of work recorded	81
Bills of sale recorded	16
Transfers recorded	4
Agreements recorded	2
Payments in lieu of work	2
Groupings recorded	11
Placer leases recorded	2

LARDEAU MINING DIVISION.

Report of Mrs. F. I. Fraser, Mining Recorder.

I have the honour to submit herewith my report of the progress of the mining industry in the Lardeau Mining Division for the year 1918.

Mining operations were very quiet during the year in this district; in fact, the slowest season the camp ever experienced. The Multiplex Mining Company, which for the past three years kept a crew of men at work developing its property, closed down early in the season, thus practically closing the camp. The usual assessments were recorded by individual owners. The old-time miners and prospectors, however, are looking forward to a new era of activity in this district, declaring that a camp so richly endowed will not long remain dormant.

Office Statistics—Lardeau Mining Division.

Free miners' certificates	44
Free miners' certificates (company)	1
Certificates of work	31
Payments in lieu of work	1
Locations recorded	31

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SLOCAN DISTRICT.

AINSWORTH MINING DIVISION.

REPORT BY R. J. STENSON, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on mining developments in the Ainsworth Mining Division for the year ending December 31st, 1918.

There is very little out of the ordinary to report, with the exception of additions and improvements to mining and milling facilities at the *Gibson*, *Cork-Province*, *Blue Bell*, and *Florence* mines. In all, twenty-three properties shipped, ranging from 3 to 5,700 tons, aggregating 17,000 tons for the district. The principal shippers were the *Blue Bell*, *Florence*, *Highland*, *Cork-Province*, *Whitewater*, *Bell*, *Spokane-Trinket*, *Utica*, *Little Phil*, and *Montezuma*.

Gibson. This claim, situated on the South fork of Kaslo creek and owned by the Gibson Mining Company, has done 700 feet of underground work, consisting of 450 feet of crosscut, 87 feet upraise, and 163 feet of drifts, uncovering new ore-shoots of good-grade mill-feed, with some shipping-ore mixed, from which 21 tons was shipped. A telephone-line has been installed connecting the upper and lower camps; this line connects with the *Cork-Province* line, which extends through to Kaslo. There has also been erected two buildings, one for a laboratory and the other for office and living apartments; the latter is 28 x 40 feet, two stories; a water-power plant; and it is expected the concentrator will be completed next summer and drilling by power started early in March.

Cork-Province. Extensive improvements were made to the mill by the installation of a 14-cell Minerals Separation machine, ball-mill, three Wilfley tables, 30-foot Dorr tank, boiler and radiator for heating mill, turbine, and a new bunk-house. With the above improvements to the mill, the company expected to be in a position to produce a selective lead and zinc concentrate; the result, however, was not satisfactory in the early stages of operation. I am informed that before the mine shut down the company succeeded, by experimenting, in producing satisfactory lead and zinc concentrates and expects a good run next year. The production was 642 tons lead-silver concentrates and 110 tons zinc-silver concentrates. An average of forty men was employed.

Silver Bell. Situated on the South fork of Kaslo creek; operated by Green Bros., in charge of W. E. Newton. Work was commenced on August 16th with six men steadily employed; the work accomplished consists of 100 feet of new tunnel, several hundred feet of open-cuts, clearing out and retimbering old tunnels, the erection of new stable, blacksmith-shop, and ore-shed. Thirty-two tons of silver-lead ore was mined.

The *Whitewater* was worked under lease; fifteen men were employed, producing 409 tons silver-lead ore and 135 tons silver-zinc ore. The former was shipped to Midvale, Utah, and the latter to Trail and Sand Springs, Colorado.

Florence. Operations at the *Florence* mine, Ainsworth, B.C., for the year 1918, while hampered to some extent by prevalent labour shortage and by delays in securing equipment and supplies, have been on the whole satisfactory, in that they have proven the expectations entertained for the property to have been well founded. Tonnage mined during the year amounted to 24,775 tons, a large portion of which came from development workings, reducing the mill-feed values. High-grade concentrates produced with the mill running one shift of eight hours a day from April to July 1st, and two eight-hour shifts from that date till the end of the year, with an average of twenty running days a month, amounted to 2,118 tons, and crude ore to 284 tons. Total shipments, all of which went to Trail smelter, were 2,402 tons, with a value of $232,466.07. Ore production was stopped on November 10th, 1917, and was not resumed until April, 1918. This was caused by the shut-down of the smelter at Trail. Completion of development-work and installation of improved equipment in the mill during the year will bring tonnage produced higher and will mean higher values in mill product.

Development-work during the year consisted of the completion of the No. 5 tunnel, 3,000 feet; the completion of the upraise from the No. 5 to the No. 2 tunnel, 365 feet; drifting and

crosscutting on intermediate levels 3 and 4, amounting to 1,000 feet; opening of new stopes on these levels and the running of a second upraise from the No. 5 to No. 2. This last is now under way and will be completed shortly. Development for the year as a whole has kept well ahead of production, and the ore-bodies now blocked out are larger than at the beginning of the year, as well as more accessible.

New equipment and camp buildings costing $35,000 were installed and completed, as follows: Locomotive and 10-car train for ore-haulage; auxiliary power plant for the mine, consisting of boiler and compressor; modern camp buildings, bunk and cook houses, accommodating 100 men; several cottages for employees. Numerous changes and additions were made in the mill equipment, which have already effected a saving in costs and have greatly increased the concentrate values.

The *Spokane-Trinket* was developed to the extent of 300 feet, consisting of tunnels, drifts, and upraises, and shipped 221 tons of ore. Six men were employed.

The *No. 1*, operated by the Consolidated Mining and Smelting Company, shipped 5,395 tons of ore. Twenty-two men were employed.

The *Highland*, operated by the same company, shipped 280 tons of crude ore and 505 tons concentrates. Forty men were employed on the property.

The *Utica* worked about three months with a crew of fourteen men, during which time they shipped 222 tons of ore. This property is owned by the Utica Mines, Limited. The above tonnage produced 13,661 oz. silver and 10 tons lead.

The *Bell* and *Sunset*, owned by the Jackson Basin Zinc Company, operated fifty days with eleven men, and produced 473 tons of ore containing 2,731 oz. silver, 16 tons lead, and 183 tons zinc.

Ainsworth Camp.

The *Little Phil*, *Maestro*, *Gallagher*, *Sky Line*, *Tariff*, *United*, and *Crow Fledgling* were worked under lease, and shipped respectively 112, 65, 56, 32, 26, 19, and 11 tons.

The *Grant*, near Ainsworth, shipped 4 tons.

The *Tam O'Shanter*, situated near the *Blue Bell*, was operated under lease by C. F. Sherwin, E. Mathews, and D. McLellan. The work consisted of an upraise of 50 feet, clearing out and retimbering 150 feet of tunnel, building wharf and blacksmith-shop. Thirty-eight tons of dry ore carrying silver values was shipped.

The *Montezuma*, on the South fork of Kaslo creek, shipped 204 tons of zinc ore which has been lying in ore-bins for several years.

Blue Bell. During January and February no milling operations were carried on because of the conditions resulting from the strike at Trail smelter during November and December, 1917. Development-work was prosecuted on the bottom level during January and February, but at the end of the latter month they penetrated a cavity in the limestone, which resulted in a temporary flow of water beyond the pumping capacity. As a result of this, the lower levels were allowed to fill pending the receipt and installation of other pumping equipment. This equipment arrived during October last, and at the close of the year the installation was nearly complete. This pump is a modified Cornish pump, operated by rod, by means of head-gear and water-wheel located in the adit level, and, so far as they know, is the only installation of its kind in the interior. Whilst this type of apparatus is high in its first cost, the operation and maintenance charges are expected to be very low. During the year there was employed an average of about fifteen men, and these, aside from doing the development and constructional work which was carried out, produced 4,800 tons of oxidized ore and 192 tons of concentrates, all of which was shipped to Trail.

The *Lincoln*, under lease to J. H. Thompson, shipped 32 tons.

The *Lavina* was worked for a short time under lease and shipped 34 tons of silver-lead ore.

The *St. Patrick*, on Hamill creek, worked steadily all year with a small crew, and has about one car of ore ready for shipment.

Manganese. Owned by Curle & Larson; situated about six miles from Kaslo, on the Kaslo & Slocan Railway. The property, consisting of six claims, was leased to B. F. Millard, of Seattle, and work commenced about June 1st and continued until about the middle of October. Ore-chutes about 250 feet long were erected, in which the ore was delivered from the working to a rotary dryer, driven by a 12-horse-power gasolene-engine, and

on to the ore-bins at the spur on the Kaslo & Slocan Railway. Fifteen cars of manganese ore was shipped during operations by Mr. Millard. Later in the season Mr. Curle shipped one car to Seattle with satisfactory results.

In addition to the above, several properties were worked on a small scale and the usual annual assessment-work performed.

OFFICE STATISTICS—AINSWORTH MINING DIVISION.

Free miners' Certificates issued	231
Locations recorded	116
Assessments	299
Bills of sale, etc.	54

Revenue.

Free miners' certificates	$1,432 25
Mining receipts	1,696 75

SLOCAN MINING DIVISION.

REPORT BY ANGUS MCINNES, MINING RECORDER.

I have the honour to submit herewith the annual report on the mining operations in the Slocan Mining Division for the year ending December 31st, 1918.

I am pleased to report that the year 1918 was the most prosperous year the Slocan has had for some time; not so much on account of the ores shipped or extracted, but mainly because the big mines have been developed and improved to such an extent as to prove beyond a doubt that the ore-bodies in this district continue with depth; also for the reason that the big mines operating in the district have for the last year been spending large sums of money in erecting concentrating plants and other outside equipments. I am quite safe in saying that the fifteen or sixteen mines operating in this district are being operated on a sound and businesslike basis; most of them backed up by capital mostly earned from the properties in which they are concerned.

Clarence Cunningham has about completed his large mill at Alamo, about two miles from New Denver. It is said by expert millmen that it is the most complete plant that ever was built in this Province; it cost about $250,000 and will be operated in connection with the *Queen Bess*, *Idaho-Alamo*, *Wonderful*, and *Sovereign* mines, all owned and operated by Mr. Cunningham, who is also operating the *Van-Roi* and *Hewitt* mills in connection with the *Van-Roi* and *Hewitt* mines.

The Rosebery Surprise Mining Company, under the management of J. P. McFadden, has taken over the *Bosun*, *Monitor-Ajax*, the *Ivanhoe* group of mines, and also the *Canadian* group, all situated in the divide between Sandon and Four-mile creek, and worked somewhat extensively some years ago by the late Yaukey & Son, of Duluth. Mr. McFadden's company is making very extensive improvements both to the mill and at the mine.

On Slocan lake, where the *Bosun* mine is situated, about one mile from New Denver, they have about sixty-five men employed, and are now running a long tunnel from the lake to get under the old workings of the *Bosun;* this tunnel will be about half a mile long. In connection with the *Bosun* they have a large mill situated at Rosebery, where they take all the feed and produce clear lead and zinc concentrates. F. J. Purphy and J. Moore are the engineers in charge.

The Standard Silver Lead Mining Company has reduced the force at the mine and is only doing development-work for a time. The Echo Mining Company has the *Standard* mill under lease and is treating its ores there.

All the other large concerns, such as the *Noble Five*, *Slocan Star*, *Rambler-Cariboo*, *Van-Roi*, *Hewitt*, *Galena Farm*, *Wakefield*, *Carnation*, *Ruth & Hope*, as well as a number of smaller concerns, are doing the usual amount of work and improvements. For the last three months miners were rather scarce and hard to get; the epidemic of Spanish influenza has reduced the number at the mines.

I am pleased to say that Mr. Langley, the Government Resident Engineer, has been a great help to many of the prospectors and small operators in this district in advising them what to do and how to do it; he certainly deserves credit for the good work he is doing.

Office Statistics—Slocan Mining Division.

Free miners' certificates issued	195
Free miners' certificates (company)	2
Locations recorded	32
Assessments recorded	112
Transfers and bills of sale	9
Revenue collected	$5,551.15

SLOCAN CITY MINING DIVISION.

Report of T. McNeish, Mining Recorder.

I have the honour to submit my report for the Slocan City Mining Division for the year ending December 31st, 1918.

Beyond the keeping-up of the yearly assessment-work on all the promising claims, very little has been done in the way of development except in a few cases, but all such work has given very encouraging results.

The *Black Prince*, under lease and bond to J. T. Tipping, has been developing and only shipped 30 tons of ore taken out while doing such work.

The *Meteor* group, which is under lease and bond to Barber & Taylor, has done extensive development-work during the past year and shipped 22 tons of high-grade ore averaging about 400 oz. silver to the ton. A deal has just been completed whereby the property is turned over to J. C. Buchanan, of Spokane, Wash., who is going to carry out extensive development-work, and has already a crew of ten men at work. He has installed a gas-engine and is going to sink on the ore, and is at present shipping the dump, which averages about 60 oz. silver to the ton.

The *Eastmont* group, owned by Ellis Silver Mining Company, has been under lease and bond to H. D. Lea & Co. and has shipped about 50 tons, having another car of ore ready to come out as soon as the roads will permit.

The *Anna* group, which is owned by Kurt Zimmerman, has done extensive development-work during the year, and he has shipped about 17 tons of high-grade ore taken out in such operations.

The *Arlington*, which is under lease to M. S. Davys, has shipped about 400 tons of low-grade ore from the dumps, and I believe that in the spring he intends to put on a crew doing development-work in the mine.

The *Republic* group, under lease and bond to Leard Bros., has been doing extensive development-work and has shipped about 13 tons of gold-silver ore taken out in such development, and has very nearly another car ready to come down.

The *Ottawa* group, owned by the Consolidated Mining and Smelting Company, shipped about 48 tons of high-grade silver ore taken out in developing, but closed down early in the season and removed operations to the *Rock Candy* group (the fluorspar mine) near Grand Forks.

The *Little Tim*, owned by D. B. O'Neal & Co., shipped 20 tons of high-grade silver ore taken out in development-work; this property looks like a steady shipper.

The *Highland Light* group, owned by Swan & Clough, shipped about 2 tons of high-grade ruby-silver ore which averages about 120 oz., and expect this year to carry out considerable development-work.

The *Lily B.* group, which is owned by Geo. Long, *et al.*, has been under lease and bond to W. A. Buchanan, who has done considerable work and has shipped 15 tons of high-grade ore, and expects in the spring to continue extensive development.

The *Evening Star*, owned by Mr. Sutherland, of Winnipeg, Man., shipped about 49 tons, but the buildings were burnt down, so had to cease operations, but I believe that in the spring operations will be continued.

Office Statistics—Slocan City Mining Division.

Free miners' certificates issued	70
Certificates of work issued	82
Locations recorded	38
Transfers recorded	7
Notices to group filed	10

Revenue.

Free miners' certificates	$ 348 50
Mining receipts, general	320 00
Poll-tax receipts	250
Resident special firearms licences	70 00
Resident general firearms licences	30 00
Ordinary firearms licences	25 00
Total	$1,043 00

TROUT LAKE MINING DIVISION.

REPORT OF OSCAR JACOBSON, MINING RECORDER.

I have the honour to submit herewith my report of the progress of the mining industry in the Trout Lake Division for the year 1918.

So far as mining development is concerned, the situation remains practically unchanged from the preceding year. Assessment-work has been kept up, however, on all the well-known mineral claims, but there was a falling-off in locations; a natural thing, as the claim-owners in the camp would rather spend their time in development of their properties than go out to look for new locations. But, the war being at an end, next summer will no doubt bring back some of the soldier-prospectors that are in service now.

D. W. Tomlinson is at present developing the *Crescent* group of claims, and if the results come up to expectations he will install a mill on the property this coming summer.

There is also a good prospect of a mill being installed on the *Foggy Day* property, owned by Mrs. A. C. Jowett, of this place.

OFFICE STATISTICS—TROUT LAKE MINING DIVISION.

Free miners' certificates (ordinary)	54
Free miners' certificates (company)	2
Locations recorded	27
Certificates of work recorded	152
Notices to group	29
Conveyances recorded	5

NELSON DISTRICT.

NELSON MINING DIVISION.

Report by Edward Ferguson, Acting Gold Commissioner.

I have the honour to submit the annual report on the Nelson Mining Division for the year ending December 31st, 1918.

Nelson Camp.

Silver King. This old mining property is being operated by the Silver King Mines, Limited; head office, Trail, B.C. Two men were employed to keep the mine unwatered. Diamond-drilling totalling 6,180 feet was done during the year. No ore was shipped and no additions to plant were made.

California. This mine is operated by John R. Cassin, trustee, Spokane, Wash.; W. H. Turner, superintendent and manager. During the year considerable development-work was done, there being an average of eight men employed. There are 1,300 feet of drifts, crosscuts, and other development-work. The ore is gold-silver, but no shipments were made during 1918. The *Athabasca* air-compressor is used for operating air-drills.

Eureka Group. This group comprises the following claims: *Eureka, Toronto, Champion, Alhambra Frac., Viking Frac., Gold Leaf*, and *Gold Leaf Frac.* The ore is copper-silver and gold. It is operated by hand-drilling. During the year 930 tons of ore was shipped to the Trail smelter. An average of eleven men was employed. A new road to the mine was built with the assistance of the Public Works Department, giving a very much improved grade. A new aerial tramway to carry ore to the Canadian Pacific Railway track at Granite was constructed at a cost of $12,340. In October this group was leased to the Inland Mining Company, of Spokane. W. M. Myers is manager and secretary.

Athabasca.—Little work has been done on this property beyond the employment of a couple of men to keep the mine unwatered. Five men were employed for a short time and one small shipment made.

Orinoco Group. This group consists of the *Orinoco, Orinoco Frac., Rio Tinto*, and *Queen Victoria Fract.* The work during the year consists chiefly of ground-sluicing and open-cuts. A considerable quantity of ore was piled up, two men having been employed about three months. The ore is copper-silver. The group is owned by Mike Egan, Nelson, B.C.

Noonday Group. This group comprises the *Noonday, Climax, Margaret*, and *Pearl Frac.* It is situated on the head of Nine-mile (from Nelson) or Sictum creek. The work done is principally on the *Noonday* claim and consists of 180 feet of tunnel and surface work. It is a free-milling gold property and is claimed to contain good values. There is a quantity of ore on hand ready to be shipped, and considerable work has been done on trail leading from the North arm of Kootenay lake to the mine. The owners are Jackson Radcliffe and John S. Johnson, of Nelson.

Monarch Group. This group consists of seven claims. Work has been done chiefly on the *Monarch* and *Elk* claims. The property is operated by the Spokane Mining & Development Corporation; Carl M. Mohr, manager and secretary. The ore is copper-gold-silver; the mine is hand-operated. About 170 tons of ore was shipped to the Trail smelter and gave good returns. An average of six men was employed, and the ore shipped was taken wholly from development-work consisting of tunnels, open-cuts, and crosscuts. Frank C. Loring is consulting engineer.

Ymir Camp.

Yankee Girl. This mine is operated by the Hobson Silver Lead Company, Limited; W. T. McDowell, manager; W. B. Ward, Jr., secretary, Ymir. The group consists of the *Yankee Girl, Canadian Girl*, and *Yukon Fraction.* The ore is an auriferous sulphide in quartz gangue. During last year 8,847 tons was shipped; 8,260 tons

going to the Canada Copper Corporation and the remainder to Trail and Grand Forks. Average number of men employed was thirty. Development-work consisted of 50 feet of 5- x 7-foot drift and 138 feet of 5- x 16-foot raise. An Anaconda air-hoist and a No. 3 Leyner drill-sharpener were added to the mine's equipment.

Development-work was done on a number of claims by D. E. Grobe and others.

Sheep Creek Camp.

Ore Hill Group. About 1,000 feet of surface work was done, with an average of five men employed. Some 336 tons of ore was treated at mine, and 14 tons of concentrates and 21 tons of crude ore shipped to Trail smelter. The ore carries gold, silver, lead, and zinc. The property consists of five claims and fractions and is considered little more than a surface prospect as yet, but, with proper machinery to treat the ore, it is expected to show good results. C. H. Cassill, Orando, Montana, is operating and W. B. DeWitt is manager.

Aspen.—About $2,000 of development-work consisting of open-cuts has been done. The ore is high grade. About 7 tons of dry ore was shipped. P. F. Horton, Salmo, is manager.

Emerald and Jersey. This property consists of the *Emerald* and *Jersey* groups and is operated by the Iron Mountain, Limited; John Waldbeser, manager; R. W. Mifflin, treasurer; D. E. McLaughlin, secretary. Several hundred feet of development-work was done, employing an average of eighteen men, and 2,092 tons of crude lead ore was shipped to the Trail smelter. An air-compressor and air-drills were used at the *Emerald* mine and hand-work at the *Jersey*. The mines were worked by crosscuts, tunnels, drifts, etc.

H.B. and Zincton.—No work has been done on this property this season.

Queen. This property has recently been bonded to A. W. McCune, of Salt Lake City and Nelson. Mr. McCune has undertaken a comprehensive exploration and development programme, and in a short time this one-time big producer will probably be again in the list of producers.

Spokane Group. Laib Bros. are continuing development-work on this promising property. Heretofore the lack of roads to furnish outlet for the ore has hindered development. This year a road was commenced up Cultus creek, which will serve a number of promising properties in the Bayonne district when completed.

The *Molybdenite* group, on Lost creek, is operated by Bennett, Ross & Benson.

Ivy Fern Group. This group, situated on Cultus creek, seven miles from Kootenay lake, was staked by T. W. Mulholland. It consists of fifteen claims. Considerable stripping was done by the locators, discovering large bodies of silver-lead ore, and a bond was taken on November 10th, 1917, by the Consolidated Mining and Smelting Company, of Trail, for a considerable sum. This company has done several thousand feet of stripping with good results and is at present driving a long crosscut tunnel to tap the veins at depth. It gives promise of being one of our large shippers. Mr. Mulholland has other claims in the vicinity that show good values.

Lost Creek and Pend d'Oreille.

The *Southern Belle* group (C. E. Wilson, manager), situated on the South fork of Lost creek, has interested Rossland and Trail capital in development programme this past summer, with reported encouraging results.

The *Lost Cabin* group, owned by Ballinger & Smith, of Salmo, is under bond to F. Shoemaker, who kept two to four men at work for several months exploring for vertical extension of rich shoot of ore exposed in surface workings.

Pend d'Oreille. Waldbeser & Reeves are reported to have opened a large low-grade lead-silver vein on the low divide between the lower Salmo river and the Pend d'Oreille, on the apparent northern extension of the silver-lead belt developed by the *Electric Point* mine, which is situated a few miles south of the International Boundary.

Erie Camp.

Second Relief. This mine is operated by the Relief Mining Company; A. D. Westby, manager. The ore is a gold-bearing quartz, the gold being recovered by amalgamation and concentration. Eighty-five tons of concentrates was shipped to Greenwood smelter from 1,241 tons of ore treated at mine. On the average eleven men were employed and

development-work consists of 50 feet blind drift and stoping. A total expenditure for new plant of $13,700 was incurred. A 4-foot Senn pan-amalgamator and a Senn concentrator were installed and 8,000 feet of new flume constructed.

Office Statistics—Nelson Mining Division.

Free miners' certificates (individual)	543
Free miners' certificates (company)	4
Free miners' certificates (special)	4
Claims recorded (mineral)	277
Certificates of work recorded	446
Agreements, transfers, etc.	92

ARROW LAKE MINING DIVISION.

Walter Scott, Mining Recorder (Office at Nakusp).

I have the honour to submit the annual report of the Arrow Lake Mining Division for the year ending December 31st, 1918.

Millie Mack.

This mine is being operated by H. E. Forster, of Wilmer, B.C., who has had a force of four men at work all summer. Thirty-five tons of sorted ore was sacked waiting sleigh transportation. The mine is developed by tunnels and the work thus far is by hand.

Big Ledge.—Nothing more than ordinary assessment-work has been done on the property this season.

Office Statistics—Arrow Lake Mining Division.

Free miners' certificates issued	41
Certificates of work recorded	11
Mineral claims recorded	21

Note.—Owing to so many free miners being on active service there were not so many certificates of work recorded as usual.

ROSSLAND DISTRICT.

TRAIL CREEK MINING DIVISION.

REPORT BY H. R. TOWNSEND, GOLD COMMISSIONER.

The mining operations in this district have been confined to some development-work in the mines of the Consolidated Mining and Smelting Company of Canada and the Le Roi No. 2 Company.

A number of claims were staked and other reverted claims leased between Rossland and the *Velvet* mines on Sophia mountain, on what is locally known as Ivanhoe ridge, owing to strong indications of chrome-iron ore; in fact, the presence of the chrome iron was proven, but whether the quality and quantity is sufficient to warrant the installation of machinery, etc., has not been determined.

Angus Cameron and associates have one large group of claims and J. H. MacDonald and his associates another.

OFFICE STATISTICS—TRAIL CREEK MINING DIVISION.

Free miners' certificates (individual)	115
Free miners' certificates (company)	5
Mineral claims located	51
Certificates of work recorded	84
Certificates of improvements	2
Bills of sale, agreements, etc.	5
Leases of reverted mineral claims	10

SOUTHERN DISTRICT (No. 4).

Report by Philip B. Freeland, Resident Engineer.

INTRODUCTORY.

The Southern Mineral District embraces what is locally known as the western portion of the Boundary District, including four Mining Divisions—i.e., the Grand Forks, Greenwood, Osoyoos, and Similkameen. The boundaries of these Divisions are shown on the accompanying map, and follow, as nearly as possible, the watersheds of the different areas. The district is exceedingly well traversed with railways and wagon-roads, which add greatly to transportation facilities, while a high-power electric line passes through the southern portion of the Grand Forks and Greenwood Mining Divisions, and is being built through the Osoyoos and Similkameen Divisions, supplying a cheap means of power to any mining industry.

For the past twenty years the Greenwood Division has been the largest copper-producer of the district. During 1918 the Canada Copper Corporation closed its smelter and its properties near Greenwood, and is now confining its energies towards the development and construction of the Copper Mountain property and mill near Princeton.

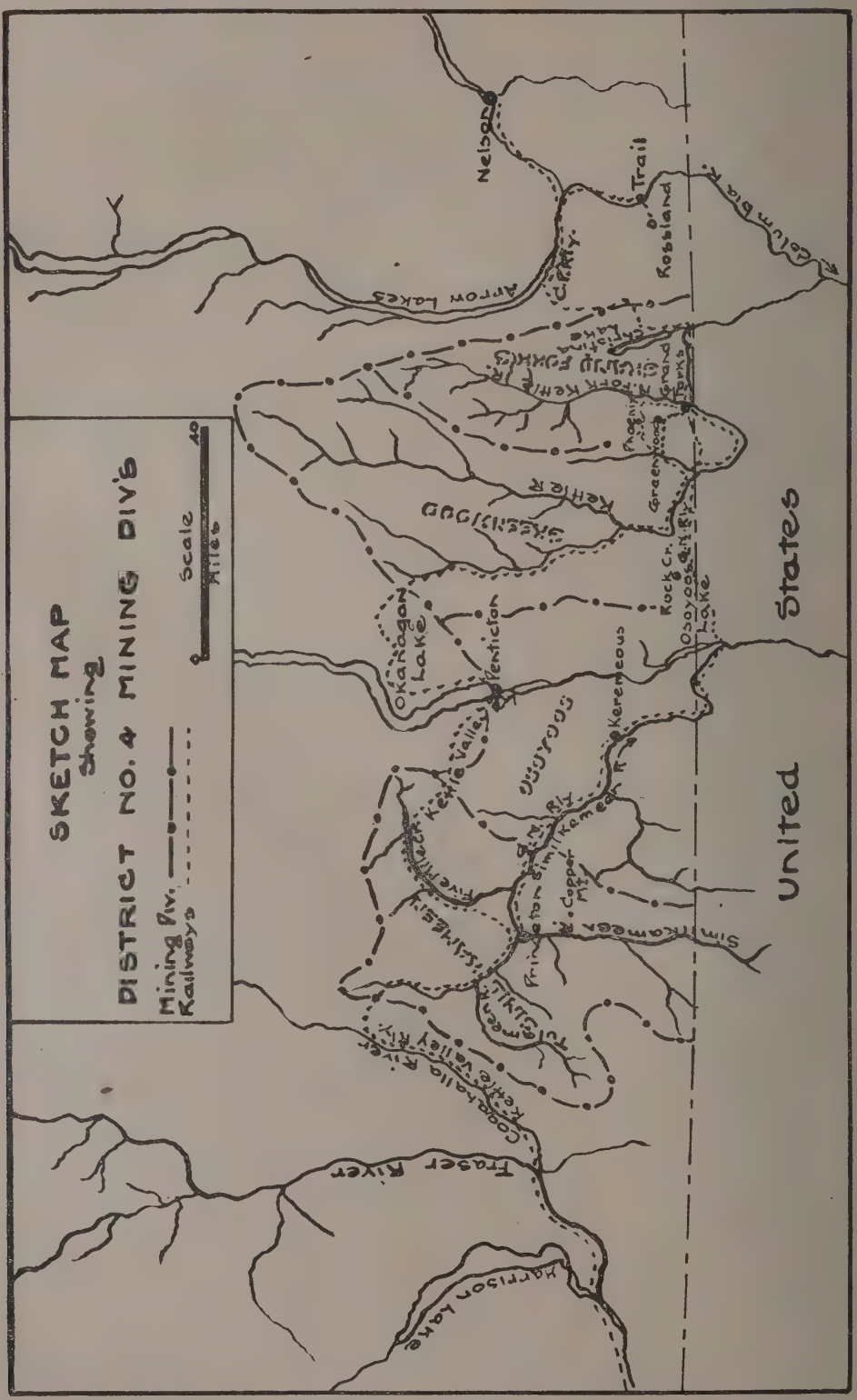
The Granby Mining and Smelting Company shipped 443,134 tons of ore to the smelter at Grand Forks during the calendar year 1918. Should the price of copper drop below 20 cents a pound and at the same time the cost of labour and supplies maintain their present prices, it will probably be difficult for this company to continue operations. It is sincerely to be hoped that this will not be the case, because the closing of the smelter will be a severe blow to the interests in the West Boundary District.

Although the above companies were unable to find any new large copper properties in the immediate vicinity of their smelters, there still remain large areas that have not been thoroughly prospected. These areas, commencing between the Canadian Pacific Railway and the Granby river (North fork of the Kettle river) at Christina lake and extending north and west, cover practically all the northern part of the Greenwood and Grand Forks Mining Divisions.

The formation is generally supposed to be granite throughout the northern and eastern portion of the district. Samples brought in from time to time by prospectors tend to show that there are well-mineralized areas, and also localities showing evidence of highly altered sedimentaries, which are the chief copper-bearing rocks of the Boundary District.

The construction of the West Kootenay power-line from Greenwood to Copper Mountain (Princeton), a distance of 100 miles, is in progress at the present time. With its completion, which is expected some time during the early summer of 1919, several comparatively old mining centres will have the advantage of obtaining electric power. As one of the chief detriments to mining in these districts in the past was the high cost of fuel, this power-line should be an incentive to more intensive prospecting over the route followed.

Commencing at Greenwood, the line passes through Rock Creek, Camp McKinney, Fairview, Keremeos, Hedley, and following the Similkameen river to Wolf creek, crosses Darcy Mountain to the Canada Copper Corporation's mill at Allenby, where the main distributing-station will be built.


SKETCH MAP
Showing
DISTRICT NO. 4 MINING DIVS
Mining Div. ——•——
Railways ----------
Scale
40
Miles
Nelson
Trail
Rossland
Arrow Lakes
Columbia R.
Kettle R.
Okanagan Lake
Penticton
Rock Cr.
Osoyoos Lake
Keremeos
Kettle Valley
Similkameen R.
Copper Mt.
Princeton
Tulameen
Coquihalla River
Fraser River
Harrison Lake
United States

List of Shipping Properties and Tonnage produced.

Division.	Mine.	Tonnage.	Character of Ore.
Grand Forks	Rock Candy	170	Fluorite.
"	Waterloo	5	Silver-lead.
"	Berlin	142	Gold-silver-copper.
"	Emma	20,613	Copper.
"	Union	153	Silver-gold.
"	Fife Quarries	41,105	Limestone.
"	Mastodon	670	Chromite.
"	B.C.	861	Copper.
Greenwood	Bell	192	Silver-lead.
"	Big Copper	409	Copper-silver.
"	Surprise No. 3	89	Copper-silver.
"	Cariboo	9	Gold-silver.
"	Rambler	6	Silver-lead.
"	Standard Fraction	51	Silver-lead.
"	Sunnyside	5	Gold-silver-lead.
"	Sudbury	3	Gold-silver-copper.
"	Providence	235	Gold-silver-lead.
"	Mother Lode	154,332	Copper.
"	Sunset	2,673	Copper.
"	Black Diamond	2	Silver.
"	Bounty Fraction	36	Silver-lead.
"	Kokomo	21	Silver.
"	Aftermath	83	Gold-silver-copper.
"	Sally	72	Silver-lead.
"	Sappho	20	Copper-silver.
"	Lakevale	5	Silver-lead.
"	Granby Co., Phoenix	443,134	Copper-silver-gold.
Osoyoos	Spotted Lake	.....	Magnesium sulphate.
"	Torpedo	135	Gold-silver-copper.
"	Horn Silver	916	Silver-gold.
"	Dolphin	46	Copper-silver.
"	Hedley Gold Mining Co.	67,313	Gold.
"	Golconda	10	Copper-silver.
Similkameen	Princeton Coal Co.	38,673	Coal.
"	Coalmont Collieries	5,744	Coal.

GRAND FORKS MINING DIVISION.

Lightning Peak.

Lightning peak is approximately thirty-three miles by road and trail from Edgewood, on the Arrow lakes, over the divide.

A good deal of excitement was created in the vicinity of Lightning peak during the year owing to the discovery of some high-grade silver ores. The country-rock surrounding Lightning peak is generally a granite. In the immediate vicinity to the west of the peak are evidences of the sedimentaries much disturbed and altered. In these sedimentaries, chiefly limestone, occur the ore-bodies of high-grade silver.

Equinox Group. To the north of Lightning peak the *Equinox* group is situated, consisting of four claims—*West Fork*, *First Chance*, *Jim Hill*, and *St. Paul*. The ore here occurs in a fissure-vein 18 inches wide in the granite; the gangue being chiefly quartz with disintegrated pieces of the wall-rock. Samples of ore shipped assayed as high as 180 oz. silver and 18 per cent. lead.

To the south and west of the *Equinox* group other discoveries of high-grade silver ore were made during 1918, the extent of which is not known.

Waterloo. This claim has developed slowly, chiefly owing to the difficulties in transportation of material necessary for opening up a mine. During the summer months the efforts of the owners were directed towards building a sleigh-road to join the wagon-road already built out of Edgewood for twelve miles. The Provincial Government has given very material assistance towards helping the owners of this camp to build the road. The shortage of labour and weather conditions have delayed construction considerably, but it is hoped that the road will be completed in 1919.

During the summer 5 tons of high-grade silver ore was transported by pack-horses to the end of the wagon-road, and thence by wagon, steamer, and rail to Trail smelter. Some of this ore assayed over 700 oz. in silver. The lead, averaging 4 feet in width, is striking in a northerly direction and occurs in a crystalline limestone close to its contact with the granite, and can be traced for several hundred feet. There has been no work done to prove the continuity of the lead at any great depth, but the owners hope to develop some tonnage during 1919.

PAULSON SECTION.

Molly Gibson. A considerable amount of work was done upon this property by the Molly Gibson Mining Company, of Rossland, B.C., during the year. The group consists of the *Molly Gibson*, *Grey Eagle*, *Manchuria*, *Irish Nelly*, and *Molly Gibson Fraction*, situated in Burnt basin and approximately four miles in a south-western direction from Paulson Station, on the Canadian Pacific Railway. These claims are all surveyed. Three other claims, covering an area on the western slope of the mountain to the railroad, are named the *Golden West*, *El Vago*, and *Steel*.

Development-work to date is as follows: Shallow pits and surface trenching sufficient to show a mineralized area about 1,500 feet in length. An inclined shaft 40 feet deep opened up a lead about 8 feet wide carrying values up to $14 a ton in gold and 2 oz. in silver. An open-cut and tunnel 72 feet in length also showed the continuity of the mineral-deposit. A crosscut tunnel approximately 200 feet long was driven to tap the ore 80 feet below the incline shaft. Some ore, it is understood, was developed by this tunnel, the value of which is not known.

From 1908 to 1911 six car-loads of ore was rawhided to Coryell Station, on the Canadian Pacific Railway, and transported to the Trail smelter. This ore, taken from near the surface, averaged $17.50 a ton in gold.

On the *Golden West*, *El Vago*, and *Steel* claims some evidence of the mineralized zone is apparent, although practically no work has been done to prove its extent. Should development on this side of the mountain uncover the ore-body, the expense of operation would be greatly lessened and a depth of 2,000 feet be obtained. The older rocks in this vicinity are limestones, argillites, and greenstones, the latter having the greatest areal distribution. A large part of the district is composed of later igneous rocks. The limestones in the vicinity of the ore-bodies are generally replaced by silica carrying small cubes of pyrite. These rocks have practically formed a jasperoid wall. The veins occur in the disturbed areas close to the contact of the pulaskite porphyry dykes with the limestones, and contain values in gold and silver.

Berlin. This property is part of the Inland Mining Company's holdings and adjoins the *Inland* mine, situated approximately four miles east of Paulson, on the Canadian Pacific Railway. Some years ago this company built a 4-stamp mill and installed concentrating-tables to treat the ore from the *Inland* mine. It was found that, in spite of the persistence of the lead and fair mineralization, the ore did not contain sufficient values to cover the expenses of operation.

Since the closing down of the mill this company continued its efforts in developing the *Berlin* claim, where some high-grade pockets of ore carrying gold and silver were encountered. Besides several hundred feet of drifting, a shaft was sunk 100 feet and a crosscut driven at the 40-foot level; a car-load of ore was broken and shipped to the Grand Forks smelter.

In October the property was leased to the Griswold-Billingsley Company, contractors. Two car-loads of ore has been shipped to the Trail smelter by the lessees. Total number of tons shipped for the year, 142, averaging about 3 oz. in gold, 15 oz. in silver, and 0.60 per cent. copper.

CASCADE SECTION.

Mastodon Group. This group, including the *Mastodon*, *Black Tail Fraction*, *Pan*, *Dominion Canyon*, and *Mammoth*, is situated on Castle mountain at an elevation of 3,500 feet above sea-level and approximately 4,000 feet from the Canadian Pacific Railway bridge which crosses the Kettle river at Cascade. The outcrops of chromite were first located many years ago, but the low price of the mineral prohibited operations at that time. In 1917 the Stewart-Calvert Company, of Oroville, Wash., obtained a lease and bond for $5,000 on the property from Angus Cameron *et al.*, of Laurier, Wash., and commenced development by stripping and sinking shallow shafts on the *Mastodon* claim, with the result that small lenses of chromite were uncovered, carrying from 30 to 50 per cent. Cr_2O_3. In 1918 the Stewart-Calvert Company graded half a mile of road from the claims to the end

of a branch of the Deep Creek wagon-road, and commenced hauling chromite with teams to the Canadian Pacific Railway at Cascade, a distance of eight miles. From thence the ore was shipped to the Central States. The haulage costs were $7 a ton and railway freight approximately $17 a ton, with an excavation cost of $4.25 a ton. A total of 670 tons of chromite was shipped, averaging 38.5 per cent. Cr_2O_3.

The smallness of the lenses of ore encountered added considerably to the expense of excavation, necessitating a lot of development-work. However, the amount of work done has not proved the size of the lenses or the fact, conclusively, that they are all of a small tonnage variety. The ore-bodies have a general strike to the north-west and south-east and dip nearly perpendicularly, having an average width of about 6 feet at the thickest part, and varying in length from 10 to 20 feet and in height 10 feet.

The rocks constituting Castle mountain are broadly classed by R. A. Daly, Geological Survey, Ottawa, as being part of the Rossland volcanic formation, constituting flows and pyroclastic deposits of latites, andesites, and basalt, with small inclusions of dunite. Closer observation has shown the dunite rocks to be far more extensive than hitherto supposed, and constitute the greater part of the southern and western slope of Castle mountain.

The serpentine appears in a number of places, but is nowhere of great areal extent, the largest mass lying near the summit of the southern peak of the mountain. These masses vary from olive-green to a light greenish-grey in colour. The slickensided surfaces are much lighter, green colour, and generally highly polished. This serpentine has resulted from the alteration of a pure dunite. The alteration from olivine to serpentine entails a considerable increase in volume, which probably accounts for the shattered, sheared, and slickensided serpentine. Although specks and very small lenses of chromite appeared in the serpentinized area, yet no commercial amount of chromite was found. The pure dunite masses outcrop chiefly at the southern end of Castle mountain, and in these masses are found commercial lenses of chromite. Only a slight serpentinization has taken place.

The ideal location of these claims, close to railway transportation and electric power, made them worthy of consideration, and should the demand for chromite again arise, the cost of mining these deposits could be greatly lessened by the construction of an aerial tramway approximately 4,000 feet long from the claims to the railroad.

Fife.

These limestone-quarries, situated on the Canadian Pacific Railway, closely adjoin Christina lake on the east side. The Consolidated Mining and Smelting Company, of Trail, B.C., is the owner and operator of the property, and has quarried 41,105 tons of limestone, used as a flux in the Trail smelters.

Grand Forks Smelter.

The recovery of 15.36 lb. of copper a ton out of a total of 19.2 lb. or a loss of 3.57, which was the average of the Phoenix ores for the year ending July 1st, 1918, was creditable from a metallurgical standpoint. A very siliceous slag was handled, with a coke-consumption of 13.98 per cent. Owing to strikes in the Crowsnest coalfield the plant was idle during a part of July, September, October, and November, 1917. During the first six months of the year an attempt was made to run six furnaces, but, the grade of ore being low, it was decided at the beginning of 1918 to reduce the tonnage and raise the grade. Copper-recovery during the first six months was 14.44 lb. a ton of Phoenix ore, and the last six months was 16.84 lb. Furnace operation for the year averaged 3.62 per cent. out of a total of eight.

The following table gives the increased costs per ton of ore treated:—

Coke	$0.326
Wages	0.093
Electric power	0.0303
Supplies	0.026
Decreased tonnage	0.106
Workmen's compensation	0.0115

* Ore treated was as follows:—

Granby	549,632 tons.
Foreign	13,202 „
Converter slag and matte	26,802 „
Flue-dust	1,531 „

* These figures are for the fiscal year ended June 30th, 1918.

The converter department produced 8,951,692 lb. of copper from the Phoenix ores, 481,965 lb. from foreign ores, and 448,690 lb. from by-products produced whilst handling Anyox matte, being a total of 9,522,347 lb. This copper was obtained from 15,700 tons of 30.4-per-cent. matte.

FRANKLIN CAMP.

This camp, situated forty-one miles from Grand Forks, on the North fork of the Kettle river, was the centre of interest for some time owing to the discovery of platinum in some of the ores. The high price of the metal, $108 an ounce (refined), was caused by its demand for munition-making during the war.

The Munition Resources Commission, then in search of platinum, sent in their representative, Wm. Thomlinson, to overlook the camp. The results of his research are given below:—

"Early in the month of August, 1918, under instructions from Geo. Mackenzie, I visited Franklin camp and took samples from the various workings on the *Maple Leaf* mineral claim, and sent the samples to the Dominion Assay Office at Vancouver, to be assayed for platinum. Two of the samples from the *Maple Leaf* claim, taken from an open-cut from which two cars of copper ore had been shipped, were found to contain, respectively, 0.15 and 0.17 oz. of platinum a ton, and the results appeared to me to indicate that the platinum content of the ore was roughly proportionate to the amount of the primary copper minerals, especially chalcopyrite, showing in the ore.

"Later, J. J. O'Neill, of the Dominion Geological Survey, visited the *Maple Leaf* claim with me, and being much interested in the mode of occurrence of the platinum, he took a sample of almost pure chalcopyrite, occurring as a small lens in the pyroxenite, and had the sample assayed for platinum at the Dominion Assay Office at Vancouver. This sample showed a content of 0.38 oz. platinum a ton.

"The mineral-bearing gangue on the *Maple Leaf* claim is mainly pyroxenite, with some inclusions of augite-syenite on the hanging-wall side of the lode, and the copper minerals, principally chalcopyrite, occur in bunches and veinlets and as disseminated specks throughout the pyroxenite and syenite.

"Owing to the good results from the *Maple Leaf* samples, and noting that the pyroxenite zone, or so-called *Black Lead*, extends almost entirely across the Franklin camp, I obtained permission from Mr. Mackenzie to remain in the camp until I had visited and sampled all of the principal properties situate on the pyroxenite-syenite contact zone.

"On most of the claims situated on the pyroxenite forming the *Black Lead* the lode material appeared to be barren of economic minerals, but on several of the claims there could be seen, at or near contacts, a tendency for the copper and iron sulphides to form mineralized belts or masses.

"Most of my samples were taken from places where such segregations of copper and iron sulphides occurred, and especially from where copper-bearing minerals were evidence; although the oxides and sulphides of iron were also included in the samples.

"Although most of the samples taken, on being assayed, showed appreciable amounts of platinum, it cannot yet be stated with certainty that more than very small portions of the *Black Lead* or pyroxenite belt can be mined on a commercial basis.

"In the samples assayed there appeared to be certain proportions between the copper-bearing minerals present and the platinum contents; but at the *Mountain Lion* claim the platinum appears to be entirely associated with sulphides and oxides of iron.

"Whether the platinum occurs in the ore as native platinum or as sperrylite, the arsenide of platinum, has not yet been determined; but I presume it may be in the latter form, and associated with the sulphides and oxides of copper and iron where they are found segregated in the pyroxenite zone.

"On several properties, such as the *Gloucester* mineral claim, situated near to and on the dip side of the pyroxenite zone, platinum may also be found to be associated with the sulphide ores; and perhaps it may be advisable to have all of the ores of the entire camp tested for the metals of the Platinum group.

"There is, however, much still to be learned regarding the mode of occurrence of the platinum, and as to the average values of the material forming the so-called *Black Lead*.

"It is probable that only certain portions of the pyroxenite zone contain platinum, copper, or other metals in economic amounts; therefore much further investigation may be required; but I certainly consider the matter worthy of detailed research on the part of the Government or of the large mining corporations.

"Samples from the under-named properties contained platinum as follows:—

	Oz. Platinum to the Ton.
Maple Leaf	3 samples—0.15, 0.17, and 0.38.
Lucky Jack	3 samples—0.04, 0.06, and 0.08.
Mountain Lion	2 samples—0.02 and 0.09.
Golden Age	1 sample —0.06.
Averill group	2 samples—0.09 and 0.09.
Buffalo	2 samples—0.08 and 0.19.
Ottawa	1 sample —0.06.
Columbia	1 sample —0.04."

Union. L. Johnson, part owner in this property, employed four men for a short period during the year, resulting in the shipment to the Grand Forks smelter, by motor-truck and rail, of 153 tons of ore, carrying values from 0.31 to 0.64 oz. in gold a ton, and from 31.4 to 50.50 oz. in silver a ton. The bonding of this property was considered by Eastern American capital and by a local mining engineer representing capital. Neither of these organizations was able to come to terms with the owners of the property.

Kennedy Creek.

Rock Candy Group. The most interesting development in this Division during the year took place on the *Rock Candy* group of claims, situated on Kennedy creek, a tributary of the Granby river (North fork of the Kettle). This group is owned and being operated by the Consolidated Mining and Smelting Company, of Trail, B.C. One hundred and seventy-seven tons of ore carrying 80 per cent. CaF_2 (fluorspar) was shipped by pack-horse and sleighs over trail and road a distance of approximately ten miles. Development-work consisted of diamond-drilling the deposit, which was unsatisfactory owing to the difficulty of retaining the broken pieces of the core in the barrel. A tunnel was also driven across the lead and a considerable amount of stripping done. An aerial tramway is in course of construction over a distance of about two miles. The lower terminal will be situated about one mile and a half north of Lynch Creek Station, on the Kettle Valley Railway.

The ore-body, from surface indications, appears to be about 500 feet long and 25 feet wide. A hurried examination of this deposit showed the surrounding rocks to be mainly of a granitic nature, cut by alkali syenite dykes. The deposit appears to be associated with calcite.

Eholt Section.

Emma. Approximately 20,530 tons of low-grade copper ore was shipped from this property during the year. Development-work consisted of 170 feet of shaft-sinking, 50 feet of pockets and stations, 1,220 feet of drifting and crosscutting, and 363 feet of raising. This mine is owned by the Consolidated Mining and Smelting Company, of Trail. About thirty-five men have been employed in the underground workings and on the surface.

B.C. In 1898 this mine was considered to have a fair chance of developing into one of the large producers of the district. From that time until 1906 about 100,000 tons of copper ore was shipped by the British Columbia Chartered Company, Limited, Montreal. In 1907 the British Columbia Copper Company took hold of the property and shipped 1,712 tons of ore. Since that time the old workings, consisting of a shaft about 200 feet deep and about 2,000 feet of levels, have been allowed to fill up with water and nothing but leasing done in and around the old "glory-hole." During the year the property was leased to J. St. Claire, of Eholt, by the Canada Copper Corporation, and 861 tons of copper ore was shipped to the Greenwood smelter. The ore-bodies occur as a replacement in the limestone, lying between lateral porphyry dykes.

GREENWOOD MINING DIVISION.

GRANBY CONSOLIDATED MINING, SMELTING, AND POWER COMPANY.

The following constitutes the report of the operations at the Granby mines at Phoenix for the fiscal year ended June 30th, 1918, by C. M. Campbell, superintendent:—

"The coke shortage referred to in last year's report continued intermittently until December, resulting in a total of two months' shut-down. Since that time there has been no trouble from this source and operations have been continuous.

"*Victoria Shaft.*—Due to the working-out of large areas of the reserves and the fact that no new ore has been opened up, this outlet is now being operated to a little better than half its capacity. Shipments for the year amounted to 317,763 tons, or 58.4 per cent. of the total. The *Victoria* ore for the year averaged 0.98 per cent. copper, 0.24 oz. in silver, 0.042 oz. in gold, 45.5 per cent. insoluble matter, 10 per cent. iron, 15.3 per cent. lime, and 3 per cent. sulphur.

"*Electric Shovel.*—Ore from this source amounted to 95,824 tons and made up 17.8 per cent. of the total shipments. This ore contained 0.95 per cent. copper, 0.20 oz. silver, 0.028 oz. gold, 40 per cent. insoluble, 14 per cent. iron, 16.7 per cent. lime, and 2.4 per cent. sulphur. At the shovel during the year 194,477 tons of waste was sorted out and a large quantity used for stope-filling.

"*Gold Drop.*—The ore from this mine totalled 128,945 tons, or 23.8 per cent. of the total. This ore averaged 0.92 per cent. copper, 0.25 oz. silver, 0.024 oz. gold, 41.6 per cent. insoluble, 13.3 per cent. iron, 16.9 per cent. lime, and 2.6 per cent. sulphur. During the year all the older portions of the mine were almost entirely cleaned up.

"*Shipments.*—Total shipments from all sources amounted to 542,532 tons. The following table shows the distribution of this tonnage and the ore shipments to date:—

	Tunnel Ore (Elec. Shovel).	Shaft Ore.	Gold Drop Ore.	Totals.
	Tons.	Tons.	Tons.	Tons.
Prior to July 1st, 1917	6,150,039	5,039,633	1,635,754	12,825,426
Year ended July 1st, 1918	95,824	317,763	128,945	542,532
Totals	6,245,863	5,357,396	1,764,699	13,367,958

"The total waste handled for the year amounted to 257,295 tons.

"The average assay per ton amounted to 0.954 per cent. copper, 0.227 oz. silver, and 0.0351 oz. gold.

"Total development to July 1st, 1918, amounted to 161,091 feet; development for the year, 7,667 feet; total diamond-drilling to July 1st, 1918, 123,019 feet; diamond-drilling for the year, 3,897 feet."

Gold Drop.

The recent exhaustion of this property has terminated mining operations which have been in progress in the eastern section of the Phoenix camp for twenty years, and which have added to the world's supply of metals about 70,000,000 lb. of copper and $3,500,000 in gold and silver. Slightly over half this was produced by the *Gold Drop* mine, the other producers being the *Snowshoe* and the *Rawhide* mines.

In 1905 the Granby Company took an option on the *Gold Drop* mine, owned by the Gold Drop Mining Company, of Montreal, Que. The only ore encountered at that time was of an indifferent character. The price asked was $250,000, and during the summer the claim was diamond-drilled and 250,000 tons of ore blocked out. It was estimated that this would yield a profit of $1 a ton, and as there were prospects of additional tonnage the purchase was made. This claim shipped 750,000 tons of ore before being exhausted, and, though a profit of a $1 a ton was not maintained, still the ore was of such uniformly good grade and had such good smelting qualities that it paid to ship.

Other properties adjoining the *Gold Drop*—i.e., *Gold Drop Frac.*, *Phillipsburg Frac.*, *Nugget*, *Snowshoe*, *Curlew*, *Monarch*, *Tamarack*, *Tamarack Fraction*, *Toboggan*, and *Missing Link*—were purchased. These claims comprise what was known as the *Gold Drop* mine and represented an investment of about $500,000. The total shipments amounted to 1,764,699 tons. In the

Plant for evaporating and refining Epsom Salts, Stewart & Calvert Co., Oroville, Wash.

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underground working square sets were originally used, but this method proved to be not only prohibitive in cost, but also unsatisfactory from a safety standpoint, and was discarded sixteen years ago. The square sets did not prevent masses of rock crushing through, while in the open slopes the ground can be examined to better advantage and dangerous pieces of rock removed.

Development-work at the *Gold Drop* mine amounted to 17,330 feet of drifting, 16,696 feet of upraising, and 39,406 feet of diamond-drilling. This amounted to approximately 1 foot of upraising, 1 foot of drifting, and 2 feet of diamond-drilling to each 100 tons of ore shipped, which is a heavy development charge. The cost of the *Gold Drop* ore on cars averaged $1.05 a ton. This figure includes all charges against the ore, except the purchase price of the property. The best costs were obtained in 1913, when ore was shipped for 77 cents a ton. Latterly, on account of frequent handling, shortage of working-places, and the war, the cost rose, and for the last year amounted to $1.54 a ton.

The *Gold Drop* mine develops only part of an extensive and practically continuous ore-body which outcrops on the *Gold Drop* claim, swings down across the *Rawhide* and *Curlew*, and terminates on the *Snowshoe* claim. The whole, when broadly viewed, has on a horizontal plan the form of a compressed crescent with northward-trending horns, broken by the occurrence of the detached ore-body of *Gold Drop No. 1* and the north body of the *Snowshoe*. The ore-body rests on a floor of jasperoids, and in the *Gold Drop* proper there is an entire absence of Tertiary intrusions, or remnants of the Brooklyn limestone.

The ore consists of chalcopyrite, which with pyrite and hæmatite in grains is finely and uniformly distributed through the gangue, composed of garnet, epidote, calcite, quartz, and chlorite. The values as determined from assays of drill-cores give from 0.90 to 3.2 per cent. copper, 0.02 to 0.07 oz. gold, and 0.20 to 0.60 oz. silver a ton. Acknowledgment is due to Chas. Campbell, superintendent of mines at Phoenix, for information connected with this mine.

The Canada Copper Corporation (Greenwood).

The smelter and properties owned by this company in the Greenwood Mining Division ceased operations on November, 1918. The town of Greenwood has for the past twenty years been the centre of various mining operations, and the closing of the smelter will work a hardship on a good many citizens in Greenwood and its vicinity, who relied on the company's operations for a livelihood.

As soon as the people of Greenwood were sure of the cessation of work, a committee was formed to investigate the possibilities of continuing smelting, with the result that the heads of the Canada Copper Corporation were requested to put a price on their holdings in and around Greenwood. Up to this time no definite answer has been received by the citizens' committee.

Oscar Lachmund, consulting engineer, of Spokane, and former manager of the company, was employed to investigate the possibilities of resuming operations. He suggested the possibilities of building a lead-furnace on the old smelter-site to treat such lead ores as might be available in the district until sufficient tonnage of copper ores could be developed. This possibility has not materialized at present.

For the past year only one of the furnaces was in operation, under the superintendence of Oscar Lachmund and Mr. Bidder. Over 168,800 tons of ore was treated during the year, not including customs ore from the United States.

The chief producing mine, owned and operated by the Canada Copper Corporation, was the *Mother Lode*, situated four miles from Greenwood. The shipments from this mine amounted to 154,332 tons of low-grade copper ore. Toward the end of the year the company experienced some difficulty in finding suitable fluxes for this ore, and had to resort to purchasing some of the output from the *Emma* mine, Coltern.

Another property closely adjoining the *Mother Lode*, named the *Sunset*, has produced 2,697 tons of copper ore. The company pumped out and exploited the *Brooklyn* mine, Phoenix, and it is understood that some good ore was exposed. Before any of this ore was broken it was decided to discontinue operations.

It is understood that the difficulty of obtaining proper fluxing-ores, together with the probability of a drop in the price of copper and the extra expense of operating mines necessitating shaft-work, caused the Canada Copper Corporation to cease operations. This company's holdings at Princeton will be dealt with under the heading of the Similkameen Mining Division.

GREENWOOD SECTION.

Providence. This property was leased to A. J. Morrison during the year. An air-compressor, hoist, etc., were installed and considerable work done in sinking and drifting. A lead in the old workings was uncovered and approximately 235 tons of ore shipped to the Greenwood and Trail smelters. This ore carries good values in gold, with a little silver, lead, and zinc.

Surprise No. 3. This mine has been under lease and bond to J. E. Thompson *et al.*, of Phoenix. Intermittent development-work has been carried on during the year, with the result that the shaft has been sunk 25 feet farther, making a total depth of 75 feet, and a tunnel driven from the bottom of the shaft for 60 feet. The mineralized part of the lead in this drift is about 4 feet wide, with a perpendicular dip striking east and west, and is siliceous replacement in the sedimentaries, containing pyrite and chalcopyrite, with traces of molybdenite. Eighty-nine dry tons of ore was shipped from the shaft and tunnel to the Grand Forks smelter, having a total content of 7,450 lb. copper and 70 oz. silver. With proper equipment this property would become one of the small shippers in the district.

Big Copper.—This claim is under lease to J. Poggi, of Greenwood. During the year 409 dry tons of ore carrying copper and silver was shipped to the Grand Forks smelter.

Sudbury.—This claim is owned by Jas. D. Graham, of Deadwood, B.C., and was worked for one month during the year, with the result that 3 tons of ore was shipped to the Greenwood smelter, carrying 0.25 oz. in gold, 12.04 oz. in silver, and 8.54 per cent. copper.

Aftermath.—This claim was operated by L. Richards and 83 tons of ore shipped to the Greenwood smelter. This ore carried values in gold, silver, and copper.

WALLACE MOUNTAIN.

Sally. This mine was leased by Jas. Drum and worked until the end of September. About 70 tons of ore was shipped to the Grand Forks smelter, carrying from 8 to 211 oz. in silver and 9 per cent. lead. A greater part of this ore was taken from the old *Sally* stopes and hauled to Beaverdell Station, on the Kettle Valley Railway, a distance of approximately two miles. From September on, Robert Wood, of Penticton, worked for two months and a half driving a tunnel below the old *Sally* workings. It is understood that when work ceased no ore had been struck.

Bell. This mine was leased and bonded to Duncan McIntosh and Chas. Oliver, of Greenwood, by Robt. Parry in 1916 for $26,000. Since then the lessees have worked continuously, doing several hundred feet of development-work, and during 1918 shipped, according to official returns, 192 dry tons of ore to the Trail and Grand Forks smelters, averaging about 150 oz. of silver to the ton, with a trace of gold. The ore occurs in a mineralized shear-zone in a quartz diorite which has been slightly metamorphosed. In some cases in and near the shear-zones the rock has been altered to a greenish-white mass. Along this altered zone occur the silver ores, including galena, sphalerite, pyrite, and native silver. A large number of faults offset the ore-bearing shear-zones, and as there seems to be no general relation between the direction of the fault-planes and the amount of displacement they have occasioned, development-work is carried on with difficulty. A good deal of credit is due Mr. McIntosh for the way he has developed the ore-bodies.

Black Diamond.—This claim is situated on Wallace mountain near Beaverdell, on the West fork of the Kettle river. The owner, Pat Kennedy, worked the property during the early part of the year and shipped 2 tons of silver ore to the Trail smelter.

Bounty Fraction and Duncan.—These claims, also situated on Wallace mountain, were leased to John McKellar, James Dale, and Pat Crane. During the summer four men were employed and 36 dry tons of ore shipped to the Trail smelter, carrying values up to 47 oz. in silver and 3.4 per cent. lead.

Kokomo.—This property is owned by G. Barrett, of Carmi. Twenty-one dry tons of ore was shipped to the Grand Forks smelter, carrying good values in silver.

Rambler.—Only one car-load of ore was shipped from this property during the year by W. Rambo, owner. Good values were obtained in silver and lead.

Standard Fraction.—This property adjoins the *Rambler* mine and is under lease to E. Nordman & Sons, of Coltern, B.C. Fifty-one tons of ore was shipped to the Trail and Grand Forks smelters, carrying between 50 and 90 oz. in silver and 2.5 per cent. lead.

Kettle Valley.

Lakevale.—A lease was taken on this claim by M. Shannier, who shipped 5 tons of silver-lead ore to the Trail smelter.

Sunnyside.—This mine is situated about one mile and a half west of the Kettle Valley Railway and about five miles north of Rock Creek. About 5 tons of ore was shipped to the Trail smelter, carrying 0.24 oz. in gold, 80 oz. in silver, and 10 per cent. lead.

Sappho.—This claim was leased to Ol. Lofstad *et al.*, of Greenwood, and 20 tons of ore was shipped to the Greenwood smelter, carrying 1.84 oz. in silver and 6.73 per cent. copper a ton.

Camp McKinney.

In 1903 the Cariboo McKinney Company mined and milled about 15,000 tons of ore, quartz carrying free gold, having a gross value of $5.50 a ton. The development of this property did not give much encouragement; consequently the company suspended operations in December of that year. Since that time practically no development was done until the Consolidated Mining and Smelting Company, of Trail, took over most of the old holdings of the company in 1917. During the year 1918 a good deal of assessment-work was done, amounting to open-cuts and shallow shafts. This work showed a continuance of the lead with some mineralization, the values of which are not to hand.

The old Cariboo McKinney Company was surrounded by difficulties, the chief of which were fuel and a long transportation haul to the nearest railroad. Future operations will be facilitated, the Great Northern Railway running to within eight miles of the properties, and a high-power electric line is being built from Greenwood to Copper mountain, at Princeton; the line running directly through the Camp McKinney properties. Future development in this area is looked forward to with interest.

The dump from the old Cariboo mill has been subleased to Leo. Mader and Ab. Savage, of Grand Forks. Under great difficulties, they erected two concentrators brought from the old mill, also a Pelton wheel. The early drought so diminished the supply of water that they were obliged to install a gasolene-engine to run the concentrators. About 9 tons of concentrates was shipped to Grand Forks smelter.

OSOYOOS MINING DIVISION.

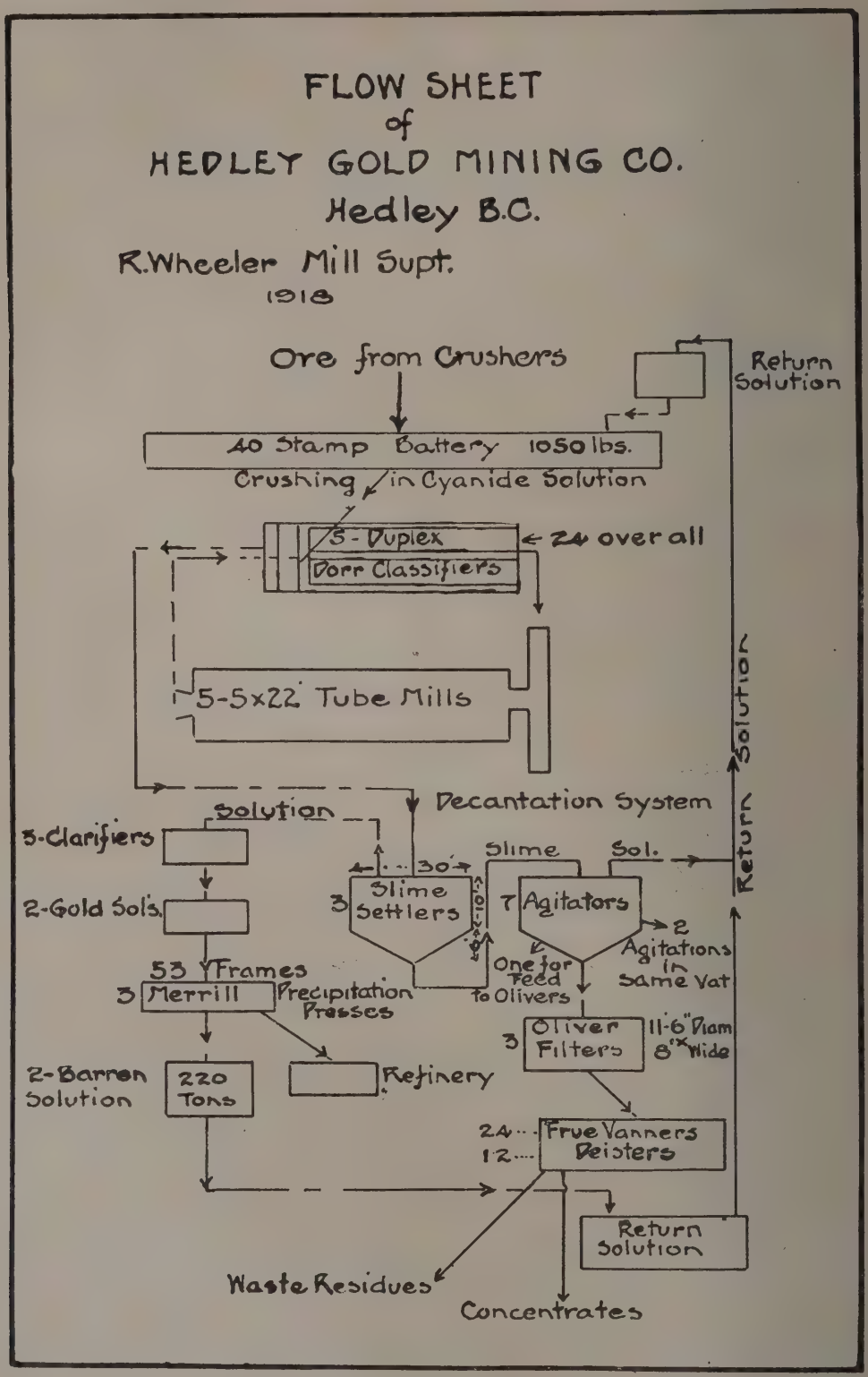
Torpedo. This mine is situated on the shore of Okanagan lake, approximately one mile from Penticton. The property has been leased by the Penticton Development Company, Penticton, B.C. The old shaft and lower tunnel, 90 feet below the level of the lake, were unwatered and the mine generally put in shape for operation. Approximately 135 tons of gold, silver, copper, and lead ore was shipped to the Greenwood and Trail smelters. Values averaging 0.35 oz. in gold, 2 oz. in silver, and 0.60 per cent. copper were extracted. The ore is a quartz carrying a variable amount of gold, silver, lead, zinc, copper, and iron.

The lead lies between two nearly perpendicular walls of granite, the gangue being mainly silica, with some disintegrated particles of wall-rock. Development has shown the lead to be persistent, though varying in size from 2 feet to 1 inch for 90 feet. At this point on the lake-level a crushed zone was encountered, and some crosscutting done to the north and south without finding a continuance of the ore-body. In the writer's opinion it would be better to drift on the strike of the lead until the crushed zone was passed before crosscutting to the north and south in search of it. The character of this ore makes it a more desirable milling project.

Horn Silver. Work has been carried on continuously during the year, despite the handicaps due to the shortage of skilled labour. Development for the year consisted of drifting on the lead and a lower crosscut tunnel, driven with the intention of tapping the lead at a lower elevation. This tunnel was not driven far enough to encounter the ore-body. Nineteen cars of ore was shipped to Grand Forks smelter via the Great Northern Railway, carrying a gross content of 99 oz. gold and 42,661 oz. silver.

Dolphin and Spar Fraction.—This property, owned by C. W. Jordan, of Olalla, was worked for twenty-six days during the year, and 46 tons of ore shipped, carrying 1.50 oz. in silver and 6.2 per cent. copper.

Copper King.—This group is again leased by R. W. Northey, of Olalla, to A. Hagelberg, who is endeavouring to develop the property at depth.


FLOW SHEET
of
HEDLEY GOLD MINING CO.
Hedley B.C.
R.Wheeler Mill Supt.
1918
Ore from Crushers
Return Solution
40 Stamp Battery 1050 lbs.
Crushing in Cyanide Solution
5 - Duplex
Dorr Classifiers
24 over all
5-5x22' Tube Mills
Decantation System
Solution
Return Solution
3-Clarifiers
2-Gold Sols.
30'
Slime
Sol.
3 Slime Settlers
7 Agitators
2 Agitations in same Vat
One for Feed to Olivers
53 Frames
3 Merrill
Precipitation Presses
3 Oliver Filters
11-6" Diam 8" Wide
2-Barren Solution
220 Tons
Refinery
24
12
Frue Vanners
Deisters
Return Solution
Waste Residues
Concentrates

Golconda. In 1917 3,390 lb. of molybdenite was shipped to Ottawa, carrying approximately 17.1 per cent. MoS_2. On driving the main tunnel ahead on the lead the molybdenite to a great extent disappeared and a good grade of chalcopyrite was encountered. About 10 tons of this ore, carrying 18.6 per cent. copper and 1.7 oz. silver, was shipped to Trail smelter. This is a good prospect.

Hedley Gold Mining Co. This company has operated the *Nickel Plate* and *Sunnyside* groups, under the management of Gomer P. Jones, steadily throughout the year, in spite of increased costs in labour, supplies, etc. The total number of tons of ore milled during the year amounted to 67,313. The recovery from this tonnage was: By cyanidation, 24,337 oz. gold; by concentration, 7,608 oz. gold; making a total of 31,945 oz. gold. The total dividends for the year amounted to $144,000.

Spotted Lake. Operations were carried on intermittently throughout the year and a number of tons of magnesium salts was hauled by motor-truck to the Stewart-Calvert plant at Oroville, Wash., for treatment.

The process for treating the salts is as follows: First the raw product, a crystalline salts dug from the lake, is dissolved in tanks by means of steam; from thence the liquid salts pass through launders into the evaporating-tanks, where it is brought to a certain density; then run off into other tanks lined with cement (magnesite), where it is cooled and recrystallized; the liquid remaining being drawn off and pumped back into the boiling tank for further treatment. The crystals are then put through a Watson Laidlaw dryer with a 2-inch basket having a capacity of 15 tons every ten hours. After this preliminary drying the crystals pass through a chute into a rotary circular dryer, 25 feet long by 4 feet in width, which revolves from eight to ten times a minute. The screens at the discharge end have meshes varying from $\frac{1}{2}$ x $\frac{1}{16}$ to $\frac{3}{32}$ x $\frac{1}{2}$ inch. Directly outside the discharge end of the screen are a set of steam-coils so placed that the fan draws the hot air over the revolving salts. The temperature is kept below 80 degrees, so that the salts will not melt.

Two grades of these salts are shipped, the finer crystals being used for medicinal purposes, whilst the coarser ones are used for tanning leather. Some of these salts are sold in the drug-stores in Vancouver.

SIMILKAMEEN MINING DIVISION.

Tulameen River.

The great demand for platinum for war purposes caused considerable activity in the vicinity of the Tulameen river. In August Chas. Camsell and Geo. A. MacKenzie, of the Geological Survey and Munitions Board Commission, Ottawa, accompanied by an expert panner, made a preliminary inspection of the Tulameen river, resulting in a decision to undertake boring operations, which were commenced in September and ceased on account of weather conditions on December 4th.

During that time ten holes were bored, of varying depths, most of which reached bed-rock, and while complete assays of the borings are not yet finished (February 1st, 1919), it is hoped that the final report of the Munitions Board will indicate the desirability of the ground.

The principal work was undertaken on what is known as Rabbit's ranch, immediately below the mouth of Slate creek. A complete survey of the Tulameen river between Slate creek and the town of Tulameen was made, and the river-bed blocked off into rectangles 200 x 500 feet, so that if at any future time the work should be continued the survey will be of material assistance to others. Details of the work undertaken will appear in the spring of 1919 in the report of the Mineral Resources Commission.

Between Bear creek and Kelly creek, on the Tulameen river, several small placer-leases have been worked for platinum and gold, with varying results.

Placer Development Co. of America, Ltd.—This company operated from July 4th to December 1st under a sublease from the Efanjay Gold Mining Company, located on the Tulameen river near its junction with Bear creek. About $25,000 was spent on building a dam across the Tulameen river, also a spillway and flumes. A deep excavation was made near the dam and the gravels hoisted on an incline tramway and dumped in the sluice-boxes. Owing to trouble with freshets in the river and the depth of gravel, it is understood that bed-rock was not reached. It is expected that work will continue next season.

OLIVINE MOUNTAIN.

A good deal of interest was centered on Olivine mountain, chiefly owing to the fact that the occurrence of platinum and chromite had been reported by the Geological Survey in 1911. The high price of these metals during the war incited certain interests in British Columbia to make further investigations into the possibilities of finding platinum and chromite in commercial quantities in the olivine rocks, which make up the greater part of Olivine mountain.

A proposal that some assistance be given these interests by the Government, in an examination of the locality with the idea of putting a diamond-drill to thoroughly prospect the ground at depth, led to the writer's visit to Olivine mountain in June. Ten days were spent traversing different localities on Olivine mountain in search of any ore-bodies large enough to be of commercial value, with the result that nothing was found that contained enough platinum or chromite to warrant the expenditure necessary for diamond-drilling.

The best showings are on the *Quartz, Copper Queen No. 1*, and *Copper Queen No. 2*, situated on the north-west slope of Olivine mountain and owned by Andy Jensen, of Tulameen. Two open-cuts on the *Copper Queen No. 1* show a fair mineralization of pyrite and chalcopyrite. These open-cuts lie about 200 feet apart and the ore seems to be disseminated through the pyroxenite in small and separated areas. General samples taken along the open-cuts assayed 1 per cent. copper, with a trace of gold and no platinum or chromite. Picked samples assayed as high as 3 per cent. copper.

In localities nearer the summit of Olivine mountain some magnetite, as an original constituent, occurs in the pyroxenite. At Courteney's cabin there is a shaft about 8 feet deep in the magnetite. This appears to be a good grade of iron ore, but the deposit is too small to be of commercial value. Samples were taken along the face of the bluff which lies to the north of Olivine mountain, with negative results.

In the fall of the year a new discovery was made by Andy Jensen, of Tulameen, on the south-east side of Olivine mountain, near Slate creek. Some stripping was done at intervals over an area of several hundred feet, with the result that carbonates and sulphides were uncovered, carrying values up to 4 per cent. copper. The extent of this deposit is not known, but the copper-carbonate stain is traceable over several claims. This occurrence is probably worth further investigation.

PRINCETON SECTION.

Copper Farm Group.

This group consists of three claims—*Copper Farm*, *Copper Farm No. 2*, and *Copper Farm No. 4*. The original owner of this group, Colonel Robert Stevenson, of Princeton, sold to the Princeton Mining and Development Company, Limited, in 1917. Since that time the property has been managed by Fred Foster, with the result that a considerable amount of development-work has been done on the lower level, also the building of bunkers, office building, and the grading of a spur from the Great Northern tracks.

The lead in the upper levels is about 6 inches wide and carries values in copper up to 16 per cent. and 2 oz. in silver. This lead, striking north and south, can be traced for several hundred feet. On the lower level considerable crosscutting has been done, with the result that the lead, though somewhat shattered and displaced, gives promise of a larger ore-body.

Regal Group.

This group consists of ten claims—*Regal*, *Rose*, *Lark*, *Hit or Miss*, *Rose Fraction*, *Regal No. 1*, *Regal No. 2*, *Regal No. 3*, and *Regal No. 4*—and is situated two miles and a half north-east of Princeton. The owners, a general mining syndicate, are developing this group under the superintendency of W. C. McDougall, of Princeton. Development-work done consists of an open-cut 150 feet in length by 25 feet in depth, this cut being continued as a tunnel for 50 feet, also extensive stripping.

The surface in the region of this work shows a strong strain of copper carbonates. Assays of samples taken on the surface give from 1.15 to 5 per cent. copper. The sulphides in the tunnel assay from 1.87 to 2.8 per cent. copper and $1.50 in gold and silver. Future development of this property will be looked forward to with interest.

Princeton Coal and Land Co.—This company's property, situated about half a mile from the centre of Princeton in an easterly direction, was operated steadily up to November 23rd, 1918, and producing about 150 tons a day. Since that time work was spasmodic on account of a fire breaking out from the old workings. The main seam, 24 feet thick, pitches 11 degrees to the

north and south, the top 7 feet of which was worked during the year. The main slope, sunk a distance of 2,323 feet, was abandoned on account of the fire, and a new slope commenced 740 feet down and 1,640 feet distant from the main workings. The area of the property is two square miles. Shipments amounted to 38,673 tons.

Coalmont Collieries, Ltd.—This property is situated between the Tulameen river and Granite creek and is under the management of Donald McLean, Coalmont. Shipments for the year amounted to 5,744 tons.

The Canada Copper Corporation, Limited.

The constructional and development programme of the Canada Copper Corporation, Limited, at Copper mountain has caused a great deal of interest in this Division during the past few years. With the completion of the plant of 2,000-ton capacity, this company's mine will stand well to the front as one of the large producers in the country. The development of the mine and building of the mill has had a wonderfully stimulating effect upon the prospecting and general mining throughout the district. A résumé of work done by this company on the *Copper Mountain* and surrounding claims during the past few years will be found below.

In 1905 the British Columbia Copper Company, since absorbed by the Canada Copper Corporation, secured a bond on the *Sunset* claim, on Copper mountain, and carried out some development-work, made a small payment, and then allowed the bond to lapse. The reason for this was probably due to the then complex problem of treating the ore, which carries about 50 per cent. silica and 20 per cent. alumina.

In 1911 the same company took options on a number of claims in Voigt camp, also on Copper mountain, and developed the property by means of diamond-drilling, open-cuts, trenches, tunnels, and shallow shafts. The result of this work has not been published and nothing further was done.

In 1912 the British Columbia Copper Company obtained another option on the *Copper Mountain* group, including the *Sunset* and ten other claims. A considerable amount of development-work was carried out upon these claims, including surface-trenching and diamond-drilling.

In 1913, 1914, and 1915 the exploration-work continued, and several thousand feet of diamond-drilling was done and some large ore-bodies developed.

In 1916 a temporary power plant was built, including one 1,100-foot and one 500-foot air-compressor; one Connersville blower, with a capacity of 3,000 feet a minute for ventilation. Besides these, machine, carpenter, and blacksmith shops were erected, also a store, bunk-house, office, and eight six-room and four two-room houses built. A power-line fourteen miles long was put in between the mine and the 500-horse-power steam electric plant at Princeton. This plant generated enough power to run the compressors, blowers, underground motors, etc., at the mine. A pumping plant for water-supply, etc., was installed on the Similkameen river, which has a head of 1,450 feet.

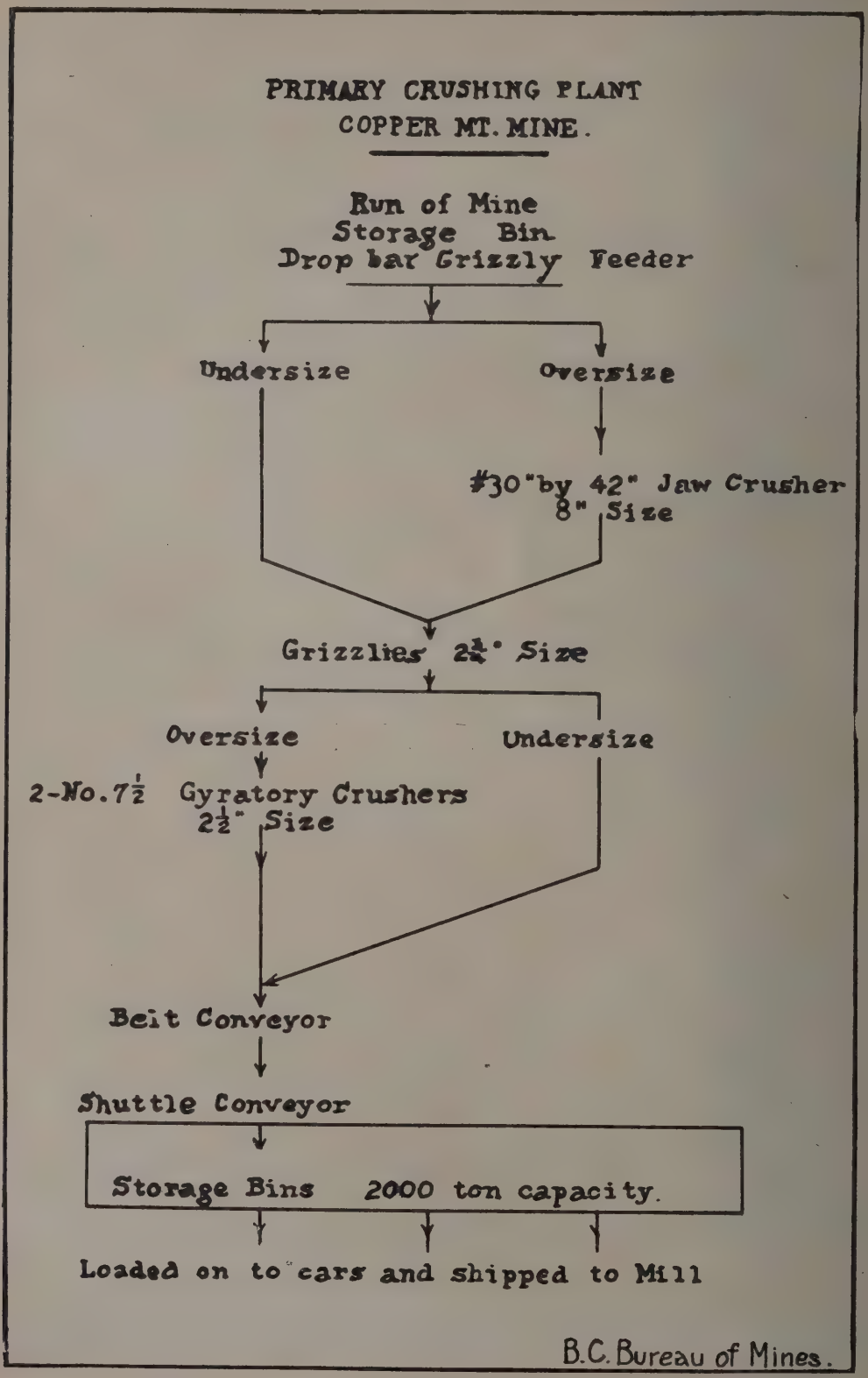
During the year 5,400 feet of drifting was done. Exploration-work was also started on Kennedy mountain, about two miles in a westerly direction across the Similkameen river, and 823 feet of drifting and 709 feet of diamond-drilling done. The results of this are not forthcoming.

Up to the end of 1917, 114,819 feet of diamond-drilling, 14,798 feet of tunnelling, 90 per cent. of which was 9- x 10-foot tunnels, 6,056 feet of upraising, 641 feet of sinking, and 25,084 feet of surface-trenching was done on the *Copper Mountain* property, with a total expenditure of about $1,250,000. All this development-work was done to ascertain as nearly as possible the size of the ore-bodies, the average grade of the ore, and the best possible means of handling a large tonnage in the cheapest possible manner. It is seldom that any property receives such a thorough prospecting before operations are commenced.

Besides analyses on all the diamond-drill holes in the ore-bodies, test-holes every few feet were driven in the tunnels with stopers and the cuttings analysed. New bunk-houses with steam-heat and shower-baths were erected for the men during 1917.

In connection with this company, the old cement plant two miles from Princeton was put into use for experimental purposes in ascertaining the possibilities of nodulizing the concentrates from the company's flotation plant. Satisfactory results were obtained from these experiments, coal-dust being used instead of oil for fuel.

During the period between 1912 and 1918 F. R. Norcross, Jr., superintended all the development-work, afterwards resigning his post to take a commission in the American Engineers.


PRIMARY CRUSHING PLANT
COPPER MT. MINE.
Run of Mine
Storage Bin
Drop bar Grizzly Feeder
Undersize
Oversize
#30"by 42" Jaw Crusher
8" Size
Grizzlies 2½" Size
Oversize
Undersize
2-No.7½ Gyratory Crushers
2½" Size
Belt Conveyor
Shuttle Conveyor
Storage Bins 2000 ton capacity.
Loaded on to cars and shipped to Mill
B.C. Bureau of Mines.

Copper Mountain Mine Buildings.

Copper Mountain Mine, 3,945-foot Level.

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Oscar Lachmund was general manager for the company until the fall of 1918, when he resigned. Since that time H. van Wagenen has been made general manager, P Crane mine superintendent, and Van H. Smith superintendent of the mill. The writer's thanks are due to the last three gentlemen for their kindness in furnishing the data in this report.

Copper Mountain Mines.—The Canada Copper Corporation's holdings on this mountain and its vicinity are as follows: Copper mountain, 96 claims, 3,192.97 acres; Kennedy mountain, 6 claims, 165.10 acres; Mill-site, 1 claim, 868.60 acres.

The mine on Copper mountain is approximately ten miles in a direct line in a southerly direction from Princeton, B.C. The ore-bodies diamond-drilled vary in size between an elevation of 3,236 to 4,220 feet, a distance of 984 feet. It may be added that most of the drill-holes stopped in ore at an elevation of 3,236 feet. The character of these ore-bodies will be dealt with later.

At the present time three tunnels have been driven into the mountain—No. 1, at an elevation of 4,073 feet, will handle all the ores from the glory-holes; No. 2, at an elevation of 3,945 feet, will handle all intermediate ores; No. 3, at an elevation of 3,170 feet, will be the main haulage-tunnel for all ores broken above. For this purpose an upraise 8 x 15 feet and 804 feet long was put in between the 3,170- and 3,945-foot levels. This upraise was driven in a zigzag manner, the corners of which will act as a buffer to the momentum of the rock dumped from the upper levels. At the bottom of raise just above the 3,170-foot level a storage-pocket was cut out. Chute-gates from this pocket will be operated by compressed air.

A vertical manway from the surface to the 3,170-foot level was also driven, work being carried on simultaneously by sinking and raising. From this manway four short drifts were driven to tap the ore-pass at different points. These drifts will be used only in case the ore-pass gets blocked and will afford a safe means of relieving the trouble.

The ores broken in the glory-holes will run down through ore-passes to the 3,945-foot level, where it will be hauled by 7-ton cars (Granby self-dumping type) attached to an electric motor and dumped into the main ore-pass running to the pocket above the 3,170-foot level. From thence 10-ton cars attached to an electric motor will haul the material to a crushing plant (not yet installed) situated close to the mouth of the tunnel. This plant will crush rock to a 4-inch size and dump it into bins above the railway.

The idea of the company when driving the different levels and upraises was to perfect, as nearly as possible, a gravity system of handling the ore. The loose nature of the ground presented difficulties, especially where the porphyry dykes cut the formation. To locate the most suitable ground for an ore-pass from the 3,945-foot level a diamond-drill was used.

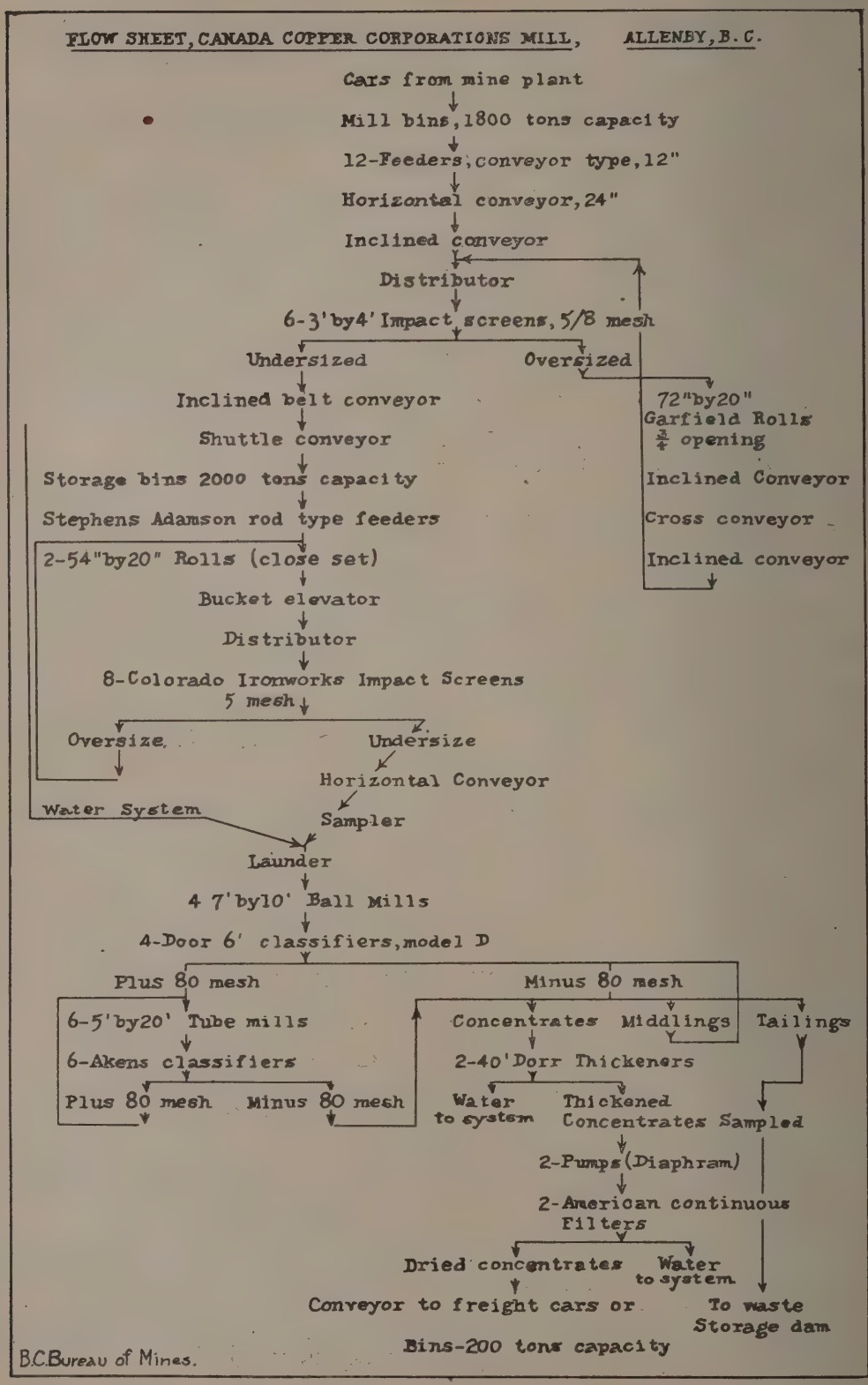
During 1918 the following development-work was done: Tunnelling, 1,720 feet; drifting, 146 feet; upraising, 2,390 feet; ore-passes, 1,017 feet; by-passes, 255 feet; total, 5,528 feet.

Geology.—The country as a whole is a mosaic of various dark-coloured granite-like rocks, which are presumably of Jurassic age. Of these rocks the augite-monzonite-porphyry is the oldest, and this in places is gneissic. The next younger rock is a granodiorite, and younger than this are intrusions of pegmatite and quartz-porphyry granites, into which the pegmatite grades. These granular rocks have by the mineralizing waters been altered to dense, fine-grained cherty rocks consisting of fine aggregates of epidote, calcite, quartz, sericite, chlorite, and metallic sulphides. Within these granular rocks it is probable that there are some small masses of Palæozoic rocks of sedimentary origin. This older complex of rocks has been intricately cut by a system of north-to-south porphyry dykes which in composition are, for the most part, the porphyritic equivalents of granites and monzonites. These rocks are of Miocene age.

The granite rocks of Jurassic age carry the ore, which consists of chalcopyrite, bornite, and pyrite, occupying the numerous fractures and also occurring in disseminated grains. The deposition of the ore took place in Jurassic times and is in part an original constituent of the granite-like rocks, and in part was deposited in the fractures by hot solutions or vapours given off by these rocks when they cooled. The associations of the ore-bodies and the porphyry dykes is wholly a physical one and relates to a single zone of structural weakness.

Chalcopyrite and bornite are the primary copper minerals present, associated more or less with hæmatite, magnetite, and iron pyrites. Along certain zones, notably in a shaft on the *Helen H. Gardner*, secondary action has taken place, giving rise to chalcocite, native copper, malachite, azurite, and cuprite.

An average of the general analyses of the ores taken from the mines is as follows: Cu, 1.77; SiO_2, 50; Fe, 5.8; CaO, 9.1; S, 1.1; Al_2O_3, 19.9; Au, 0.005; Ag, 0.20.


FLOW SHEET, CANADA COPPER CORPORATIONS MILL, ALLENBY, B.C.
Cars from mine plant
Mill bins, 1800 tons capacity
12-Feeders, conveyor type, 12"
Horizontal conveyor, 24"
Inclined conveyor
Distributor
6-3'by4' Impact screens, 5/8 mesh
Undersized
Oversized
Inclined belt conveyor
Shuttle conveyor
Storage bins 2000 tons capacity
Stephens Adamson rod type feeders
2-54"by20" Rolls (close set)
Bucket elevator
Distributor
8-Colorado Ironworks Impact Screens
5 mesh
Oversize
Undersize
Horizontal Conveyor
Water System
Sampler
Launder
4 7'by10' Ball Mills
4-Door 6' classifiers, model D
Plus 80 mesh
Minus 80 mesh
6-5'by20' Tube mills
6-Akens classifiers
Plus 80 mesh
Minus 80 mesh
72"by20" Garfield Rolls 3/4 opening
Inclined Conveyor
Cross conveyor
Inclined conveyor
Concentrates
Middlings
Tailings
2-40' Dorr Thickeners
Water to system
Thickened Concentrates Sampled
2-Pumps (Diaphram)
2-American continuous Filters
Dried concentrates
Water to system
Conveyor to freight cars or Bins-200 tons capacity
To waste Storage dam
B.C. Bureau of Mines.

The company hopes that the construction of the railway, high-power line, crushing plant at the mine, and installation of the machinery to run the mill will be completed during 1919 and the mine put on a producing basis.

Whether the produce from the mill is to be nodulized or shipped as a concentrate has not been definitely decided by the company. A conservative estimate of ore blocked out amounts to 10,000,000 tons, whilst there is 2,000,000 tons of semi-proven ore.

The Mill.—The location for a mill-site was chosen by the Canada Copper Corporation at a point 5.5 miles from Princeton by railroad, close to the Similkameen river, on a slope so characterized that a gravity system could be used as much as possible and the least amount of excavation undertaken. The location of the railroad was also taken into consideration, it being necessary to hold a nearly uniform gradient from Princeton to Copper mountain and at the same time pass through the company's holdings at the mill-site.

Excavating for the foundations was commenced in August, 1918, and preliminary structures erected to facilitate the handling of concrete for the foundations and the timber for the mill. Excellent material for making the concrete was excavated from a cut-bank close to the mill-site, filled into cars, and dumped into a mixing-bin above the works.

Two timber towers 440 feet apart on parallel rails, with a steel cable strung between, were erected. By this means the frame-timbers were easily swung into place. At present no machinery has been installed, and will not be until the completion of the railway to the mill-site.

A pumping system has been installed on the Similkameen river 600 feet below the mill, with a capacity of 850 gallons a minute. This will supply the mill and town. A sawmill has been erected with a capacity of 30,000 board-feet a day. Practically all the lumber for constructional purposes, except the larger sizes, was the direct output of this mill. All timber to be used in and around the mine will be sawn and framed at the mill, then shipped by rail 7.7 miles.

Half a mile on the north side of the mill the company has erected cottages for fifty-five employees, also a school to accommodate forty children, a store, bunk-houses, and dining-room. On the north side houses will be erected for the staff.

The Kettle Valley Railway is constructing a branch line from Princeton to Copper mountain, a distance of 13.2 miles, which will handle all the tonnage from the mine to the mill. Power will be supplied by the West Kootenay Power Company on the completion of their line from Greenwood to Copper mountain. The present proposed plan of the mill flow-sheet accompanies this report.

BOUNDARY DISTRICT.

GREENWOOD MINING DIVISION.

REPORT BY W. R. DEWDNEY, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining operations in the Greenwood Mining Division for the year 1918.

Granby Consolidated Mining, Smelting, and Power Co., Ltd.—Tonnage shipped, 443,134. Development: Drifting, 3,616 feet; raising, 4,107 feet; sinking, 15 feet; diamond-drilling, 5,544 feet; average number of men employed, 230; amount expended in wages, $410,000. There were no new additions to mine plant.

The *Gold Drop* mine of the Granby Phoenix group was permanently closed down on July 15th, the ore-body being worked out. The crushing and generation plant formerly at the Curlew tunnel entry to the *Gold Drop* mine has been moved to the mouth of No. 3 tunnel. The mine enjoyed an uninterrupted run during the entire year.

Consolidated Mining and Smelting Co. of Canada, Ltd.—The *Emma* mine produced 26,261 tons of ore and shipped 20,613 tons. The average number of men employed during the year was thirty-five; wages paid, $56,801. The advance for the fiscal year ending September 30th, 1918, totalled 1,817 feet. Total diamond-drill footage for the year amounted to 1,346 feet.

WALLACE MOUNTAIN, NEAR BEAVERDELL.

The *Bell* mine, leased to Charles Oliver and Duncan McIntosh, made shipments to the Granby Company's smelter, Grand Forks, and to the Consolidated Mining and Smelting Company at Trail. Total wages paid out to miners, not including management, $7,654; average number of miners employed, 6. The work consisted of drifting 350 feet and raising 35 feet.

Sally.—The following is the result of the operations on this mine from January 1st to September 30th, when the lessee, James Drum, discontinued working the property:—Shipped to Trail smelter: Lot 50, 7,935 lb., 586 oz. silver, 532 lb. lead; Lot 51, 11,899 lb., 1,170 oz. silver; 1,021 lb. lead. Shipped to Grand Forks smelter: Lot 20, 50,934 lb., 590 oz. silver; Lot 21, 70,234 lb., 280 oz. silver. The Wallace Mountain Mining Company, of Penticton, is now developing this mine.

Buster and Alaska.—J. Kelly *et al.* are working on these claims. The *Buster* adjoins the *Standard*. About 7 tons of ore is ready for shipment. Development consisted of a tunnel 75 feet on the *Buster* and open-cut and surface work. From two to three men have been employed from July 1st last. The ore is silver-lead.

Castor Fractional.—This claim is under bond to Robert Perry, George Hambly, and R. D. McKenzie. I am informed there are good prospects of ore being shipped this winter.

Bounty Fractional and Duncan.—Under bond to McKellar, Dale & Crane. Thirty-six tons of ore was shipped from the *Bounty Fraction*. Approximately 40 feet of drifts were driven and four men employed during the year.

Rambler.—W. H. Rambo shipped 6 tons of ore from this property in 1918. A 30-foot shaft was sunk and a tunnel 25 feet long driven.

Standard Fractional.—This claim is under bond to Nordman & Sons. The work done consisted of drifting 170 feet, raising 84 feet, and considerable stoping. They shipped 9 tons of ore to the Trail smelter, which carried 850 oz. in silver, 783 lb. of lead, and 4.3 per cent. zinc. Forty-nine dry tons was shipped to the Granby smelter at Grand Forks and 2,481 oz. of silver realized. Three men employed.

Revenge Group.—G. M. Barrett, who is working this group, has about 9 tons of ore sacked and ready for shipment. Development was 90 feet of drifting and open-cut work and a car-load of ore is blocked out ready for stoping. The lead looks very promising.

Napanee Group.—Owned by E. G. Cummings and M. D. Schenck. A 50-foot tunnel was driven and 150 feet of trench and open-cut work.

Scandia.—Ninety feet of drifting and considerable open-cut work was done.

Carmi Camp.

Carmi.—This mine was pumped out and sampled by the owners, but no further work was done.

Arlington Camp.

The necessary yearly assessment-work was kept up on the claims in this camp.

Providence.—This mine is situated near Greenwood and is leased to J. A. Morrison *et al.* During the year 235 tons of ore was shipped from this property; the values extracted were: Gold, 155 oz.; silver, 22,474 oz. Average number of men employed, 6.

Surprise No. 3.—Situated near the town of Phoenix. About 150 tons of ore was taken out, which averaged 5 per cent. copper, 75 cents in gold, and $1 in silver a ton. A shaft 75 feet deep was sunk and two drifts run from this shaft—one 60 feet and one 30 feet long. The ore occurs in a fissure-vein. Average number of men employed, 3. This is considered to be a good property and the ground is closely staked round it.

Fidelity, Don, General Haig, Millington, and Vimy Ridge Group.—Owned by George White *et al.* and situated on Floyd's ranch, near Greenwood. The ore is silver-copper. Development-work consisted of a tunnel 60 feet long and an open-cut 200 feet long and 4 feet deep.

Smith's Camp.

General Joffre Group.—This group consists of some fifteen claims owned by Claude Gidon *et al.* The ore is copper and the owners have great faith in their venture.

Don Pedro.—This mine, situated in Greenwood camp, is being worked by Charles Johnson *et al.* The ore contains gold and silver. About 20 tons of ore is ready for shipment.

Camp McKinney.

According to the preliminary report of Philip B. Freeland, Resident Engineer, the Consolidated Mining and Smelting Company did a considerable amount of work upon its holdings in this camp during the summer. A continuance of some of the quartz leads were uncovered, showing a fair amount of mineralization.

In the fall the West Kootenay Power Company established two camps near the old *Cariboo* mine and commenced cutting a right-of-way for the high-power electric line, which, it is understood, will pass through the Camp McKinney on its way from Greenwood to Copper mountain.

Cariboo.—A. Savage and Leo. Mader, of Grand Forks, obtained a sublease on the tailings from the old mill. Under great difficulties they erected two concentrators below the dump, also a small Pelton wheel. The early drought so diminished the supply of water that they were obliged to install a gasolene-engine to run the concentrators in place of the Pelton wheel. Notwithstanding these difficulties, about 9 tons of concentrates was shipped to the Grand Forks smelter.

Lightning Peak Camp.

Waterloo.—Situated on the headwaters of Kettle river, about thirty miles in a north-westerly direction from Edgewood, on the Arrow lakes. The lessees, George Boug and Charles Hammarstadt, packed on horses 9,381 lb. of high-grade ore to Edgewood to be forwarded from that point to the Trail smelter for treatment. The shipment netted $3,244.53. The ore contained silver almost entirely, but 375 lb. of lead was extracted.

Lumpy Group.—Owned by W. B. Johnstone *et al.* They are endeavouring to ship some ore to the Trail smelter, providing transportation difficulties can be overcome.

Lightning Peak.—This mine is under lease to W. A. Calder. I am informed 2 tons of ore was shipped to the smelter at Trail last fall.

Many prospectors will visit this locality in the spring. Several promising claims were staked last fall. If sufficient ore is discovered to warrant the expenditure, a wagon-road should be built from the camp to connect with the road which runs ten miles in a north-westerly direction from Edgewood.

Canada Copper Corporation, Ltd.—Tons of ore treated at smelter from all sources, 177,307. Production: Blister-copper, 2,841,378 lb.; gold, 12,662 oz.; silver, 60,495 oz. Average number employed for year: Smelter, 51; *Mother Lode*, 61; *Lone Star*, 8. Wages paid: Smelter,

$83,054.80; *Mother Lode*, $103,537.10; *Lone Star*, $8,669.15. Principal ores treated: *Mother Lode*, 154,332 tons; *Lone Star*, 3,057 tons; *Sunset*, 2,674 tons; *B.C.*, 861 tons; all others, 16,383 tons.

The Greenwood smelter of the Canada Copper Corporation closed down about the middle of November.

OFFICE STATISTICS—GREENWOOD MINING DIVISION.

Free miners' certificates issued	202
Locations (quartz)	115
Locations (placer)	1
Rerecords (placer)	4
Certificates of work	173
Permits to search for lode	2
Bills of sale	10
Agreement	1
Assignment	1
Filings	25

GRAND FORKS MINING DIVISION.

REPORT BY S. R. ALMOND, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining in the Grand Forks Mining Division for the year 1918.

With the exception of the opening of the fluorite properties on Kennedy creek, on the North fork of the Kettle river, by the Consolidated Mining and Smelting Company of Canada, there was not any advance in mining operations over the preceding year. The fluorite properties include the following mining claims: *Rock Candy No. 1*, *Portal No. 1*, *Rabbit*, *Tadanac*, *Fluorspar*, and *Decimal Fractional*. At the present time from 90 to 100 men are employed on these properties.

The *Emma* mine, situated at Coltern, belonging to the same company as the fluorite properties, has been worked continuously throughout the year.

The Inland Empire Company and the Molly Gibson Company did some work on their properties during the year; the properties are situated near Paulson. The *Union* mine, in Franklin camp, on the Granby river (North fork of the Kettle), also did some work.

I understand that P. B. Freeland, the District Engineer for District No. 4, will give a report covering the Grand Forks Mining Division, so I have refrained from giving any details or extending this report, as he is in a far better position to give the details, being conversant with everything pertaining to mining in this district.

OFFICE STATISTICS—GRAND FORKS MINING DIVISION.

Free miners' certificates	149
Records of locations	103
Certificates of work	113
Bills of sale, agreements, etc.	27
Filings	16

OSOYOOS MINING DIVISION.

REPORT BY J. R. BROWN, GOLD COMMISSIONER, FAIRVIEW.

I have the honour to submit the annual report on mining operations in the Osoyoos Mining Division for the year 1918.

I regret to say that as a whole this year very little new work was done, owing partly to the scarcity of labour, many men having been called to the war, and also the lack of capital for investment in mining properties.

The old producing mines, such as the *Nickle Plate* at Hedley, *Horn Silver*, near Cawston, and the *Spotted Lake* group produced about the same quantities. No new properties of any consequence were shown up.

The Power Company's line has not yet reached Camp Fairview, though it shortly will do so.

Office Statistics—Osoyoos Mining Division.

Locations	101
Certificates of work	23
Bills of sale, etc.	34
Leases of mineral claims	4
Free miners' certificates	201

SIMILKAMEEN MINING DIVISION.

Report by Hugh Hunter, Gold Commissioner.

I have the honour to state that I have not had an opportunity of visiting any of the mining camps during the past season, and am not in a position to give any information concerning the work. Mr. Freeland's (District Engineer) report will cover the district generally.

Office Statistics—Similkameen Mining Division.

Free miners' certificates	193
Free miners' certificates (special)	5
Location records	268
Certificates of work	320
Conveyances	26
Powers of attorney	17
Certificates of improvements (mineral claims)	16
Records (placer)	10
Leases	15

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CENTRAL DISTRICT (No. 3).

REPORT BY R. W. THOMSON, RESIDENT ENGINEER.

Central Mineral Survey District No. 3 comprises the seven Mining Divisions of Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale, aggregating in superficial area approximately 45,000 square miles.

PHYSIOGRAPHY.

The major portion of this district is included in the Fraser plateau of the Interior system. The western boundary, however, merges into and includes the easterly spurs of the Coast range and a small part of the Cascade mountains. The physical features along with the geology of the district have been described by several distinguished authorities engaged at different times carrying out investigations for the Geological Survey of Canada.

GEOLOGICAL BIBLIOGRAPHY.

For the benefit of those who may desire a more detailed knowledge of the geology of the district than it is possible to give in this brief report, the following works which have come under the perusal of the writer are mentioned:—

Bateman, A. M. Geology of Fraser Canyon and Vicinity, B.C. Siwash Creek Area. Summary Report, C.G.S., 1911, pp. 125-129.

Exploration between Lillooet and Chilko Lake, British Columbia. Summary Report, C.G.S., 1912, pp. 177-187.

Lillooet Map-area, British Columbia. Summary Report, C.G.S., 1912, pp. 188-210.

Camsell, Charles. Fraser Canyon and Vicinity. Geology of a Portion of Lillooet Mining Division, Yale District, B.C.

Geology of Skagit Valley, Yale District, B.C. Note on the Occurrence of Diamonds at Tulameen and Scottie Creek near Ashcroft, B.C. Summary Report, C.G.S., 1911, pp. 108-124.

The Geology of certain Portions of Yale District, B.C. Summary Report, C.G.S., 1912, pp. 211-220.

Reconnaissance along the Pacific Great Eastern Railway between Squamish and Lillooet. Summary Report, C.G.S., 1917, Part B, pp. 12B-23B.

Daly, R. A. Reconnaissance of the Shuswap Lakes and Vicinity (South Central British Columbia). C.G.S., 1911, pp. 165-174.

A Geological Reconnaissance between Golden and Kamloops, B.C., along the Canadian Pacific Railway. C.G.S., Memoir 68 (No. 59, Geological Series), 260 pp.

Dawson, G. M. Preliminary Report on the Physical and Geological Features of the Southern Portion of the Interior of British Columbia. G.S.C., Report of Progress, 1877-78, pp. 1B-187B.

Report on the Area of the Kamloops Map-sheet. G.S.C. Annual Report, 1894, Vol. VII., N.S.

This report on the "Area of the Kamloops Map-sheet" by Dr. Dawson, who had as his assistant in the work J. McEvoy, takes in a large part of the area in District No. 3, and is looked upon as the standard of reference by all succeeding investigators of geological phenomena in this particular area. It covers a space of 427 pages, in which is included an appendix of fifty-two pages giving the petrographical character of some of the rocks from the same area, as determined by Dr. W. F. Ferrier, F.G.S., at that time lithologist to the Geological Survey of Canada. More recent investigations have modified somewhat the classification of the geological formations as presented in Dr. Dawson's report. The most important modifications are in regard to the Kamloops Volcanic group and the Adams Lake series. The Kamloops Volcanic group is discussed by Dr. Drysdale* as follows:—

"The former classification and correlation of the formations by Dr. G. M. Dawson have been followed in general, with, however, the two following notable exceptions: It has been found necessary to replace the name Lower Volcanic group used for the extensive development

* Geology of the Thompson River Valley below Kamloops Lake, B.C., G.S.C., 1912.

Sodium Carbonate Lake (Red Rock), near 70-Mile House, Cariboo Road.

Epsom Salts Lake, near Clinton, B.C.

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of Jura-Cretaceous rock (mapped as Tertiary on the Kamloops map) in the western portion of the section by the new term *Spence Bridge Volcanic group*. Again, it has been thought advisable to include the Lower Volcanic group and Tranquille beds in the vicinity of Kamloops lake, which are undoubtedly Post-Eocene in age, with the conformably overlying Upper Volcanic group, and call the whole by the new term *Kamloops Volcanic group*."

Of the Adams Lake series Daly* writes: "The writer follows Dawson's own suggestion and designates the sediments and associated volcanics of the complex under the name 'Shuswap series,' which excludes the plainly intrusive granites, pegmatites, and orthogneisses. The whole assemblage of sedimentary volcanic and plutonic rocks is here for convenience called the 'Shuswap terrane.'

"During the field season it became convincingly clear that the Shuswap series includes also two great formations which had been referred by Dawson to the Cambrian; these are the 'Nisconlith' limestone with the associated rocks and the Adams Lake series. The evidences that these rocks are not only Pre-Cambrian but also Pre-Beltian were given in the Summary Report for 1911.

"The distribution of the Shuswap rocks as shown in Map No. 1458 was chiefly determined by Dawson, who states that they extend northward to the Finlay river, between the 56th and 57th parallels of latitude. They do not appear anywhere in the Rocky Mountain system, nor are they known in the Coast range."

Drysdale, C. W. Geology of Thompson River Valley below Kamloops Lake, B.C. Summary Report, C.G.S., 1912, pp. 115-150.

Bridge River Map-area, Lillooet Mining Division; Highland Valley Copper Camp, Ashcroft Mining Division; Human Skeleton from Silt-bed near Savona, B.C. Summary Report, C.G.S., 1915, pp. 75-92.

STRUCTURAL GEOLOGY.

Table of Formations.†

			Approx. Thickness in Feet.
Quaternary	Recent	Soil and subsoil	....
	Pleistocene	Fluvio-glacial deposits	....
Tertiary	Lower Miocene	Kamloops Volcanic group, basalt, andesite, agglomerate, breccia, and tuff (Tranquille beds)	3,000
	Oligocene (?)	Ashcroft rhyolite porphyry	1,000
		Coldwater group, conglomerate, sandstone, and shale	5,000
Mesozoic	Lower Cretaceous	Queen Charlotte Islands formation (?), chiefly shale, conglomerate, and sandstone	5,000
	Jura-Cretaceous	Spence Bridge Volcanic group, lipartic and andesitic lava, tuff, arkose, and conglomerate	5,000
	Upper Jurassic (?)	Granitic intrusives	
	Jura-Triassic	Nicola group, greenstone (porphyrites), impure quartzite, argillite, limestone, agglomerate, and tuff	10,000
Palæozic	Carboniferous	Cache Creek group, cherty quartzite, argillite, greenstone, and limestone (Marble Canyon limestone)	9,500

Erosion Unconformity.

Pre-Cambrian (Pre-Beltian)	Shuswap terrane	Intrusive granites, Shuswap series:	
		Adams Lake Volcanic	10,000
		Tshinakin limestone-metargillite	3,900
		Bastion schists (phyllites, etc.)	5,000
		Sicamous limestone	3,200
		Salmon Arm mica-schists	1,800
		Chase quartzite	3,000
		Tonkawatla paragneiss (?)	1,500

* Memoir 68, C.G.S., 1915.
† Pre-Cambrian after Daly; Palæozoic up after Drysdale.

GEOLOGICAL HISTORY.

In order to present an idea of the sequence and nature of the geological events in this district, the following synopsis by Drysdale* is given:—

"SUMMARIZED GEOLOGICAL HISTORY OF THE REGION.

"The geological history of this region may be presented for the sake of conciseness in the following tabular scheme:—

"(1.) Downwarp of a mid-Palæozoic peneplain with the transgression of a Devono-Carboniferous epicontinental sea. Probably warm tropical climate. General marine sedimentation with local vulcanism (Cache Creek group).

"(2.) Uplift and local deformation of coastal plain deposits toward the close of the Palæozoic; followed by cycle of erosion. Humid cool climate (?). Moderate relief. Organized drainage. Continuous sedimentation in some coastal regions.

"(3.) Trangression of Jura-Triassic sea. Probably semi-arid climate. Marine sedimentation in shallow seas accompanied by pronounced igneous activity (Nicola group).

"(4.) Orogenic uplift—'Jurassic revolution.' Birth of Sierra Nevadas and Coast range and batholithic intrusions of the Pacific coast (granitic intrusives). Youthful topography. Rapid sub-aerial erosion. Chiefly consequent drainage followed by subsequent, etc.

"(5.) Jura-Cretaceous continental sedimentation and widespread volcanic activity. (Spence Bridge Volcanic group.) Semi-arid climate. Rugged probably fine textured topography with many volcanic peaks. Disorganized drainage.

"(6.) Lower Cretaceous sedimentation in brackish waters and in part marine. (Queen Charlotte formation.) Cool humid climate (?). Mature topography.

"(7.) Epeirogenic uplift and local deformation with possibly granitic intrusions. Followed by Cretaceous cycle of erosion during long period of crustal stability in which the land surface was brought down to a peneplain. Coarse-textured topography. Transverse courses of Thompson and Fraser rivers inherited from this Cretaceous peneplain.

"(8.) Laramide revolution. Epeirogenic upwarp of Cretaceous peneplain with maximum uplift along the axes of present mountain ranges. Probably humid, cool climate. Continuous sedimentation into the Tertiary in some coastal regions.

"(9.) Early Tertiary continental erosion and sedimentation (Coldwater group) with local rhyolitic eruptions (Ashcroft rhyolite porphyry). Moist semi-tropical climate (?). Major streams antecedent with slightly different courses than at present. Drainage rejuvenated and much of it disorganized with many local lake-basins. Development of topography from state of youth through adolescence to post-maturity.

"(10.) Oligocene diastrophism. Widespread elevation with intense local deformation (possibly birth of Rocky Mountain system proper). Followed by Oligocene erosion cycle which removed much of the early Tertiary rock record and paved the way for later planation. Semi-tropical climate.

"(11.) Lower Miocene volcanic activity. (Kamloops Volcanic group.) Slight topographic relief. Drainage locally disorganized by lava-flows.

"(12.) Mid-Miocene crustal warping with local buckling and faulting of Lower Miocene volcanics. Probably intrusion and extrusion of alkalic rocks to the south and east in the Boundary and West Kootenay districts.

"(13.) Late Miocene and Pliocene cycle of erosion during long period of crustal stability. Production of peneplain in the Interior plateau and mature to post-mature erosion surface in bordering mountain ranges (old upland erosion surface). Coarse-textured topography in Interior plateau and finer-textured in Coast range. Climate becoming cooler. Drainage well organized.

"(14.) Differential uplift of epeirogenic character in late Pliocene or early Pleistocene. Uplift slow enough for antecedent streams, some of whose courses were inherited from a Cretaceous peneplain to maintain their general courses. Pre-glacial erosion with deep incision of Pliocene drainage within the upland surface (youthful valleys). Drainage, therefore, antecedent from Pliocene and rejuvenated.

"(15.) Pleistocene glaciation. Arctic climate with milder interglacial period. Cordilleran ice-cap softened the contours of the old upland topography; steepened the slopes of the youthful

* C.G.S., 1912, page 149.

valleys and left on its retreat much morainic and outwash material. (Admiralty period of Pacific coast.) Followed by slight subsidence with deposition of clay-silts in lakes.

"A recent advance of valley glaciers (Vashon period of Pacific coast) is recorded which further modified the youthful valleys and supplied considerable till and outwash material. Followed by alluviation and deposition of much gravel, sand, and silt.

"(16.) Post-glacial erosion cycle. Uplift. Excavation of valley-fill by meandering river into river terraces. Incision of canyons, gorges, and ravines.

"(17.) Recent river deposits, landslides, and mud-creeps. The Interior Plateau climate is dry with extremes in temperature; while in the Coast range it is humid and temperate."

OPERATIONS.

In reviewing the operations carried out in District No. 3 during the past year under the heads of the different Mining Divisions, it may not be out of place to state the fact that this district at the present time stands lowest in the output of metalliferous products. This has no doubt been due, to some extent, to difficult transportation conditions. These have been ameliorated to a considerable degree by the building of the Canadian Northern Railway, the Pacific Great Eastern Railway, and the Kettle Valley Railway, but development-work in connection with the mineral resources of the district is still in its embryonic stage, although distinctly encouraging.

The duties of the Resident Engineer have consisted to a large extent in investigating whether conditions in new prospecting areas warranted Government assistance in the matter of trails and roads for the purpose of encouraging development-work wherever indications were promising. In this connection a considerable amount of work has been done, the results of which were not considered sufficiently interesting to incorporate in this report.

In the following notes in some cases advantage has been taken of information furnished by the Mining Recorders of the district, and also of reports by other authorities.

CLINTON MINING DIVISION.

The area covered by this Division consists largely of Tertiary volcanics underlain on the west by highly tilted Cretaceous rocks which themselves overlie the granitic intrusives of the Coast Range mountains. The metalliferous production to date has been very limited, but reliable reports of promising copper discoveries west of Chilko lake have recently come in.

The results of prospecting-work in this Division generally point to a future in products which are probably due to the alteration of the basic volcanic rocks which predominate in this area—chromite, epsomite, magnesite, and sodium carbonate.

Scottie Creek.

Chrome-Iron Deposits.

These comprise two claims—the *Iron King* and *Iron Queen*—which are being operated under bond by Stewart & Calvert, of Oroville, Wash., who also hold other claims adjoining under locator's licence. The property is situated on the west bank of Chrome creek, about half a mile from its junction with Scottie creek, a tributary of the Bonaparte river. The distance from Ashcroft is approximately twenty-one miles, seventeen of this being on the Cariboo road, running from Ashcroft to Clinton. At the time the mine was visited (April, 1918) it was reached by a trail four miles in length, running up Scottie creek from the 17-Mile on the Cariboo road; during the past summer, however, the operators have completed the construction of a wagon-road to take the place of the trail.

The chromite occurs, associated with serpentine, in a peridotitic belt apparently about a quarter of a mile in width, striking north-easterly and running along the west bank of Chrome creek. In going up the trail along Scottie creek from the Bonaparte river wide belts of limestone and argillite are passed. These probably belong to the Cache Creek group, so that the peridotitic belt in which the chromite occurs apparently lies between Tertiary volcanics on the east and the Cache Creek formation on the west.

On page 285, Minister of Mines' Report for 1915, there is a report on this property by W. M. Brewer, from which the following extract referring to the *Iron King* claim is taken:—

"The most important of these outcroppings shows on a point between two gulches, and a crosscut trench 20 feet long and about 6 feet deep has been made across a bed of fairly solid

ore about 3 feet thick, dipping to the north; but sufficient work has not been done to permit of any estimate being made as to extent of the deposit. A sample was taken by the writer of selected ore from the dump of several tons at the entrance to the open-cut. This assayed as follows: Chromium, 22.6 per cent., equivalent to 33 per cent. chromic oxide."

From the date of Mr. Brewer's report the property remained idle until early in 1918, when the present operators started development-work, employing a small staff of men during the year.

At the time of my visit in April the ore-dump at the open-cut referred to in Mr. Brewer's report had been increased to approximately 100 tons, and from a new open-cut about a quarter of a mile farther to the east, on the *Iron Queen* claim, approximately 150 tons of ore had been extracted. This was sampled, and gave on assay at the Provincial Assay Office: Chromic oxide (Cr_2O_3), 22.50 per cent.; silica, 27.2 per cent. The owners claim much higher values than the above figures would indicate. The workings are at an altitude of about 2,900 feet.

Since the above-mentioned examination was made a tunnel 40 feet in length has been driven in the *Iron Queen* claim, and it was stated by the management that a total of 500 tons of shipping-ore has been mined, but no shipments have yet been made.

About a quarter of a mile to the north-east of the working last mentioned there is an occurrence of chromite ore, of which a sample was taken across 13 inches, and which gave on assay: Chromic oxide, 24 per cent.; silica, 35 per cent.

Magnesium Sulphate (Epsom Salts).

One mile and a half south of Clinton, on the east side of the Cariboo road, is a small lake, area not calculated, but in the neighbourhood of 12 acres. In the summer-time this evaporates to dryness, leaving a crust of practically pure magnesium sulphate 4 to 6 inches thick; this is underlain by a quantity of less pure material several feet in thickness.

During the past year Stewart & Calvert, of Oroville, Wash., have been operating the property, and up to the end of the year had shipped 150 tons of the purer surface crust over the Pacific Great Eastern to different points in the United States, leaving about 2,000 tons in storage at the lake. Since the beginning of the present year, 1919, shipments have been continuous, including a considerable amount of the more impure material which was sent to their refining-works at Oroville for treatment. The material is removed from the lake by the use of picks or bars, shovels, and barrows.

Soda Lake or Red Rock Lake.

Situated about three miles west of the 70-Mile House on the Cariboo road. This lake, which has an area of 100 acres, contains in solution sodium carbonate to the amount of 6 per cent. by weight. The total amount of solution has not been estimated, but the lake appears to be rather shallow in depth. Its altitude is 3,700 feet. There are other smaller lakes in the vicinity of a like nature.

The owners of the mineral rights are the Pacific Coast Contractors, Limited, Vancouver. During the past year this company installed an evaporating plant having a capacity of 2 to 3 tons of crystal soda in ten hours. This was operated during the latter part of the season and 20 tons of crystal soda was shipped. The plant has been closed down for the winter. This property is only three miles from the Pacific Great Eastern Railway.

Magnesite.

During the past year considerable interest has been manifested in the magnesite-deposits of this Division, for the reason, no doubt, that the early completion of the Pacific Great Eastern Railway will bring occurrences of this nature within the category of commercial possibilities. Although the writer has had no opportunity of making an examination of any of the occurrences mentioned, there is no doubt of the existence of very promising prospects of this material, as evidenced by the standing of those interested in their development.

Near the 105-Mile House on the Cariboo Road is a hydromagnesite-deposit within three-quarters of a mile of the line of the Pacific Great Eastern Railway. This is referred to by Dr. Dawson in the C.G.S. Report for 1898. The present owner is E. A. Carew-Gibson, Vancouver.

Near the town of Clinton C. E. Cartwright, of No. 445 Granville street, Vancouver, is developing a magnesite prospect, of which he writes under date of October 25th as follows:—

"Our progress has been much slower than expected, due to the depth of drift covering and the fact that for the greater portion of the time we have only employed one man. The indications

are good and have improved greatly during the last two weeks. We are now getting plenty of small angular pieces of white and grey crystalline magnesite in a tunnel being driven on the *Anzac* claim, half a mile south-east of the town of Clinton. I hope to be able to prove that there is a bed of solid magnesite several hundred feet wide in the mountain-side above the snow-white deposit in the valley bottom."

About fourteen miles west of the 59-Mile on the Cariboo Road is a large deposit favourably reported on by Dr. Hodge, of the University of British Columbia. L. Reinecke, of the Geological Survey of Canada, has examined these occurrences during the past summer, and will no doubt have something interesting to say of them in the C.G.S. Summary Report for 1918.

LILLOOET MINING DIVISION.

Cadwallader Creek Area.

The most important producing area at the present time in this Division is the Cadwallader Creek gold-bearing zone. W. M. Brewer, in his report on the Lillooet Mining Division, appearing in the Minister of Mines' Report for 1913, devotes fourteen pages (253-266) to this particular district, giving comprehensive reports on all the properties working at that time, which were considerably more in number than have been in operation during the past two years.

In the 1915 C.G.S. Summary, page 75, there is a report by C. W. Drysdale on the Bridge River map-area, discussing the geology of the district and giving reports on the *Coronation* and *Pioneer* mines. In the "economic geology" section of this report and referring to the Cadwallader gold occurrences, Dr. Drysdale states:—

"The main mineralized belt was found to occupy the western flank of the Ben d'Or mountains, forming an arc concave toward the centre of the mass. This arc corresponds to a part of the western limb of the Bridge River anticlinal dome which is compressed against the Coast Range batholith and intruded by steeply dipping cupola stocks and tongues of granodioritic rocks. The ore-deposits appear to be genetically related to these younger intrusives and are found in the cover-rocks of the underlying batholith. The gold-quartz deposits are confined mainly to the Cadwallader diorite, which has proved, because of its hard, compact, homogeneous nature, to be physically a good formation to preserve regular and persistent fault-fissures. The fissures have served as channels for the heated alkaline carbonate solutions containing gold, which were given off during the later stages of batholithic invasion and consolidation. At certain localities in the fault-fissures where temperature, pressure, and other physico-chemical conditions were favourable, free gold was deposited from solution to form ore-shoots."

In the 1916 C.G.S. Summary, page 47, further references are made by the same authority to the *Pioneer*, *Coronation*, and *Lorne* mines.

This district was visited during the latter part of November, 1918. There was a considerable amount of snow in the neighbourhood of the working mine, the altitude being about 3,900 feet.

Pioneer. This mine is situated on the north side of Cadwallader creek, camp on south side, fifty-four miles by wagon-road from Mission Station, on the Pacific Great Eastern Railway, on Seton lake. The registered office of this company is at No. 432 Richards street, Vancouver. The mine superintendent is J. F. Widen, Lorne Mine Post-office. The general equipment consists of: One 6- x 8-inch Jenkins double-cylinder hoist, good for 400 feet depth, working a 1-ton automatic-dumping-skip; one 8- x 10-inch jaw-crusher, No. 5 Brandt mill (Chilian type), capacity 1 ton an hour through 40-mesh screen, with Challenge feeder; one double-deck Deister concentrating-table for tailings from amalgamating-table; two compressors, Ingersoll-Rand, 3-drill capacity each. The reduction plant is operated by a 190-horse-power turbine-wheel supplied by water from a flume which taps Cadwallader creek about a quarter of a mile above the mill. This wheel also supplies power for running a sawmill and a dynamo for lighting purposes around mill and camp.

During the year 1918 the main shaft was continued to a depth of 208 feet from the collar, being 80 feet below the previous lowest workings. A short crosscut to the north was run in to catch the vein and drifts started east and west; at the date of examination (November 19th) the east drift had reached a distance of 40 feet from the shaft and the west drift a distance of 80 feet from the shaft, the vein showing strong throughout, and the values said to be as good as any previously encountered in the mine. This vein is really composed of two veins, Nos. 1 and 2, which run together, forming one vein, as shown on the 200-foot level for a distance of 60 feet to the west and 40 feet to the east of the shaft, separating on the east side at an angle of 10 degrees

and crossing on the west side and diverging at an angle of 8 degrees; both are of pay value. No. 2 is supposed to be older geologically and of somewhat higher value than No. 1. Milling was suspended from July 21st to October 13th to allow shaft-sinking operations to be carried on.

On November 17th fire destroyed the hoist-house and blacksmith-shop, which again stopped production for some little time. Gold produced during the year to November 16th amounted to 1,925 oz. It was estimated another 500 oz. would be produced by the end of the year.

Lorne. Owner, Arthur Noel, Lorne Mine Post-office. This mine is situated three miles north-west of the *Pioneer* mine, in the widest part of the Cadwallader diorite-belt, on the north side of Cadwallader creek and about fifty-one miles by wagon-road from Mission Station. The property is fully described in the report by Mr. Brewer previously referred to, and in which nine distinct ore-bodies are mentioned as occurring on this property. The deposit might be classified, not improperly, as a *stockwork* system, as other veins have been opened up since Mr. Brewer's examination was made. The reduction equipment is very simple, consisting of a 5-stamp (750-lb.) sectional battery, small crusher, and amalgamating-table. Power is supplied by a 30-horse-power Pelton wheel. There is also about 500 feet of tram-track laid for conveying ore to mill-bunkers.

During the past year, on account of the scarcity of labour, operations were confined to development-work only, and 380 tons of ore was milled from this source, yielding 192 oz. of gold and 37 oz. of silver. The results from this development were very promising, some of the faces where the veins had pinched opening up again into pay-ore, surface-trenching also uncovering new leads. In the face of a crosscut from the drift on what is called the Wedge lode a lead was struck carrying strong mineralization having a grey metallic appearance. A sample of this was taken and sent to the Provincial Mineralogist for assay; the grey mineral was classified as arsenical pyrite, the sample going 1.16 oz. of gold to the ton. This occurrence is different from the free-milling ore of the district and is deserving of further investigation.

Coronation.—(*See* report by Provincial Mineralogist, 1910; also Mr. Brewer's report, 1913.) This property has not been operating since the summer of 1917.

Ida May. This property lies to the west of and adjoins the *Coronation* mine. In Mr. Brewer's report of 1913 he states that no work had been done since his examination in 1901, when there was a total of 278 feet of development done on two distinct veins. Samples taken by Mr. Brewer in 1901 gave: From upper vein across 2 feet, $23.20 in gold a ton; a grab sample from dump, $6 a ton; a sample from lower vein across 3 feet 6 inches, $3.20 in gold a ton.

Recently F. A. Brewer, of Vancouver (not the Mr. Brewer whose reports are quoted), acquired the property, and during the past summer installed a small reduction plant consisting of a jaw-crusher, a Huntington mill of 10 tons per 24 hours capacity, and amalgamating-table, the power being furnished by a 10-horse-power gasolene-engine. A trial run was made and the work closed down for the winter. It is the intention to resume operations in the spring. The development-work now stands as follows: Upper workings, 500 feet incline and drifts; lower tunnel crosscut, 100 feet; drifts 90 feet east and 30 feet west. Ore will be taken from lower tunnel.

Wayside. This mine is situated on the north side of Bridge river, forty miles by wagon-road from Mission Station, on the Pacific Great Eastern, being operated by D. C. Paxton with a force of two men. Work has consisted in continuing the main adit referred to in Mr. Brewer's report; this had reached a distance of approximately 700 feet in the month of November, but no developments of particular interest were reported.

The above-mentioned four properties are the only ones on which work of any magnitude has been carried out during the past two years in the Cadwallader diorite-belt. I have not in my possession figures as to the total amount of gold produced from this district since work first began, but it must have reached a fairly large figure. This fact taken in conjunction with the favourable reports by eminent geologists and the encouraging results from the rather casual nature of the prospecting-work so far carried out, makes it difficult to understand why development on a broader scale than that hitherto carried out has not been undertaken. No doubt transportation difficulty has been to a large extent responsible for this condition, the distance now that the Pacific Great Eastern is operating still being over fifty miles by wagon from the nearest station on the railway to the centre of mining operations.

Arlo Group. Three claims owned by Davidson & Marquis, Lorne Mine Post-office. Situated on south bank of Bridge river about one mile below Gun creek. Conditions did not allow of this property being visited. The following information was furnished by Mr. Davidson: A well-defined ledge running in a southerly direction; a tunnel on same 25 feet in length; width of ledge at portal 5 feet; 14 feet from tunnel ledge is 10 feet in width; balance of tunnel all in ore; width of ledge not determined.

A sample of the ore was sent to the Department of Mines, Ottawa, for investigation, and the following description of it was returned to Mr. Davidson: "Altered basic rock with veinlets and scattered particles of nickeliferous iron sulphides, a small amount of quartz, and a green chromiferous silicate which may be altered to or identical with mariposite." The precentage of nickel was not given in this return, but another and larger sample was sent for a more complete analysis, the results from which had not been received at the time of the interview with Mr. Davidson.

Copper Mountain.

Situated on Gun creek. A certain amount of work consisting principally of open-cutting was carried out on this property during the year. Charles Camsell, British Columbia representative of the Geological Survey of Canada, made an examination of the property during the past summer; his report will no doubt appear in the Annual Summary for 1918. The following table of distances along the Bridge River wagon-road from Mission Station, on the Pacific Great Eastern, Seton lake, may be useful to intending travellers in the Bridge River district: Mission to Rexmount Post-office, 18 miles; Mission to Tyaughton creek, 28 miles; Mission to Gun creek, 38 miles; Mission to South fork of Bridge river, 42½ miles; Mission to Lorne Mine Post-office, 50½ miles; Mission to *Pioneer* mine, 53½ miles.

TENQUILLE CREEK AREA.

Tenquille creek is a small stream emptying into the Birkenhead river from the west at a point on the latter stream about nine miles from where it diverges from the line of the Pacific Great Eastern Railway at Mile 71 from Squamish. The area in which claims have been staked is situated in the vicinity of the headwaters of the Tenquille, about six miles from where it joins the Birkenhead.

The claims are reached by taking the wagon-road from Pemberton Station up the Lillooet river for a distance of fifteen miles to McLeod's Crossing. The Lillooet is crossed by canoe, pack-horses wading at low water. From here a rough trail leads up over a saddle-back in the divide between Tenquille and Lillooet rivers, rising from an elevation of 750 feet at the Lillooet to 5,500 feet where it crosses the divide. The total distance from Pemberton by this route is approximately twenty-seven miles to the centre of the claim area. This is a difficult route, the trail in one five-mile portion rising on an average grade of about 18 per cent.

During the past year a new route was located, starting from Mile 71 on the Pacific Great Eastern Railway and following the Birkenhead river to the Tenquille creek; then up this creek to the claims. A portion of this trail has been constructed and completion will probably follow in the spring. This trail when completed will bring the claims within fourteen miles of the railway, over a wagon-road grade, or approximately half the distance of the present route. Very little development-work has been done in the area on account of the difficulty of getting in supplies.

The following extract referring to this locality is taken from the C.G.S. Summary Report for 1917, Part B. The report is made by Mr. Camsell from notes taken by Mr. Hanson during an examination of the district:—

"The rocks of this locality consist of conglomerate, sandstone, slate, limestone, and schists cut by a number of dykes and sills of quartz porphyry and granodiorite porphyry, probably apophyses from an underlying batholith of granodiorite. The deposits are associated with the porphyry dykes and are situated either in them or on their contacts with limestone or schists, and the chief values are in copper, with less amounts of gold and silver.

"On the *Eva* group, owned by Phil White, the ore, which is 6 feet wide, occurs as a replacement of siliceous, sericitic schist along the border of a dyke of quartz porphyry, and contains chalcopyrite, pyrite, and some zinc-blende and bornite. Surface assays of the ore are said to have yielded as much as 8 per cent. of copper.

"On the two groups adjoining the *Eva* group—namely, the *Regal* and *Copperplate*—the ore occurs in shear-zones 4 or 5 feet wide in quartz porphyry, and the mineralization is by chalcopyrite, pyrite, and zinc-blende. On these three groups the development-work consists of open-cuts and shallow pits.

"Situated a few miles south of the *Eva* group, on the ridge between Lillooet valley and Tenquille creek, at about 6,800 feet elevation, are a number of other claims owned by McLeod. The ore here appears to be the indefinite contact-metamorphic type in limestone on the borders

Lorne Mine, looking East, Lillooet M.D.

Pioneer Mine, looking Across and Down Cadwallader Creek.

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of a granite porphyry. Mineralization is mainly by magnetite and some chalcopyrite over a zone from 8 to 50 feet in width. Here also the development-work consists of open-cuts and shallow pits."

Referring to the *Eva* group mentioned in the above extract, the writer took a sample across 4 feet 6 inches at the bottom of an open-cut at a depth of 12 feet vertically below the surface; this gave on assay at the Provincial Assay Office: Copper, 2 per cent.; silver, 0.80 oz. a ton; gold, trace.

Thelma Maud Group. This group comprises four claims and is owned by T. Lewis, of Vancouver. These are situated on a high ridge lying to the north of Tenquille creek, between it and the Birkenhead river. The side sloping toward the Birkenhead river is very steep and precipitous from the top of the ridge downward for a vertical distance of nearly 2,000 feet; continuing toward the river the slope is more gradual, although still fairly steep, the surface being made up of the talus broken away from the bare rugged face of the ridge referred to. The country-rock is the schist mentioned in Mr. Camsell's report. At several places in this exposed face appear zones of mineralization in which chalcopyrite predominates, the general direction of strike being vertically up and down the face. One of these showing the best exposure was followed up the face for a distance of approximately 1,500 feet. It appeared to consist of a mineralized parting in the schist, carrying fairly high-grade chalcopyrite running in width from a knife-edge up to 6 inches. From this parting in places the mineralization extends with more or less persistency into the country-rock. As no work had been done on this property, no samples were taken.

Lillooet Lake.

An examination was made of some of the properties lying on the south side of the west end of Lillooet lake. The formation here is described by Camsell as consisting of quartzite, argillites, limestone, and schists. Samples were taken from several of the properties, but as assay results were not promising a description would be of little interest.

Copper Queen. Situated on the east side of Owl creek and operated by Copper Queen Mining and Smelting Company. A full report by W. Fleet Robertson, Provincial Mineralogist, is given in the Minister of Mines' Report for 1916, page 270. Geology by Camsell in C.G.S. Summary Report, 1917, Part B, page 19B. A small amount of development has been carried out since Mr. Robertson's report.

A considerable amount of prospecting-work is going on in the vicinities of Lillooet lake, Birkenhead river, and Owl creek.

KAMLOOPS MINING DIVISION.

Iron Mask. Situated about seven miles in a south-westerly direction from the city of Kamloops. This is the only mine in District No. 3 operating a reduction plant of any magnitude. In the Minister of Mines' Report for 1915 there is a comprehensive report on this property by W. M. Brewer, giving a description of the geology, underground workings, surface equipment, power-installation, and transportation arrangements at that date. The following information was supplied by the superintendent, A. E. Wallinder: The management, transportation system, and general power arrangement remain the same as at the time of Mr. Brewer's report referred to. During the past two years a considerable amount of underground development has been carried out, as well as approximately 8,000 feet of diamond-drilling. From the 750-foot level of the *Iron Mask* claim a raise has been put up to connect with the 300-foot level from the *Erin* shaft. This raise is about midway between the two shafts, which are 1,500 feet apart, and serves as an outlet for the ore from the *Erin* claim, which is taken along the 750-foot level to the *Iron Mask* shaft and hoisted to the concentrating plant.

The diamond-drilling was carried out from the 750-foot level for the purpose of locating the original *Iron Mask* ore-body, which was cut off at the 690-foot level by a horizontal fault (*see* Mr. Brewer's report); this has been located and development-work is being directed toward opening it up.

The water-concentrating plant described in Mr. Brewer's report has been entirely discarded in favour of a "flotation system." During the year 1917 a plant having a capacity of 150 tons gross in twenty-four hours was installed. This proved so satisfactory that another unit of like capacity was added early in 1918. Each unit is comprised of a jaw-crusher, Macey ball-mill,

three rougher Callow cells, one Callow finishing-cell, Dorr classifier, and Dorr thickener; and for the two units a settling-tank, Oliver filter, and storage-tanks for the liquor from the settling-tank, making a closed circuit for the oil-impregnated water. The whole plant is electrically operated, power being supplied by the city of Kamloops light and power plant.

The concentrating plant has not been operated to full capacity during the year 1918, the total shipments of copper concentrates amounting to approximately 2,800 tons. The power-consumption for the year was approximately 1,400,000 kilowatt-hours.

(*See* report by W. M. Brewer in Minister of Mines' Report, 1915, page 221.)

Lydia Group. This property is situated on Canyon creek, a tributary of and flowing northerly into the North Thompson river, and is approximately seven miles south of Birch Island Station, on the Canadian Northern Railway. The altitude of the workings is, roughly, 5,700 feet, the creek directly below being about 5,200 feet, and Birch Island, on the Canadian Northern Railway, 1,360 feet. The property now comprises a block of fourteen claims and is being operated for New York interests under the direction of R. H. Stewart and management of P. W. Racey, both of Vancouver, No. 736 Granville street.

The country-rock generally appears to be of the nature of a chloritic schist cut by porphyritic and other types of igneous dykes and probably belongs to the Pre-Cambrian Adams Lake series. On the west side of the creek a zone of mineralization consisting principally of chalcopyrite associated with iron pyrite is exposed for a considerable distance along the steep face of this west bank, striking in a S. 40° W. (mag.) direction and dipping to the north-west (mag.). The object of the development-work now being carried out is to determine values and quantities in this mineralized occurrence.

During the past year a considerable expenditure has been made and a large amount of work accomplished, a good deal of the latter being of a preliminary nature. A trail seven miles and a half in length has been constructed from Birch Island. This is wide enough to allow a narrow-gauge wagon or sleigh to be used, so that transportation can be carried on throughout the year. A new camp has been built at the foot of the hill large enough to accommodate twenty men, and consisting of bunk-house, cook-house, compressor building, office, oil-house, and tool-shed, also blacksmith-shop at the workings. A compressor plant operated by gasolene-engine of 2-drill capacity has been installed, which gives a pressure of 80 to 100 lb. a square inch at the machine. A complement of eighteen men working on two shifts is employed.

Two tunnels are being run on the ore-body. At the end of the year the figures on development-work were: No. 1 tunnel, 220 feet drifting, 63 feet crosscutting; No. 2 tunnel, 270 feet drifting, 52 feet crosscutting, and 62 feet of raising.

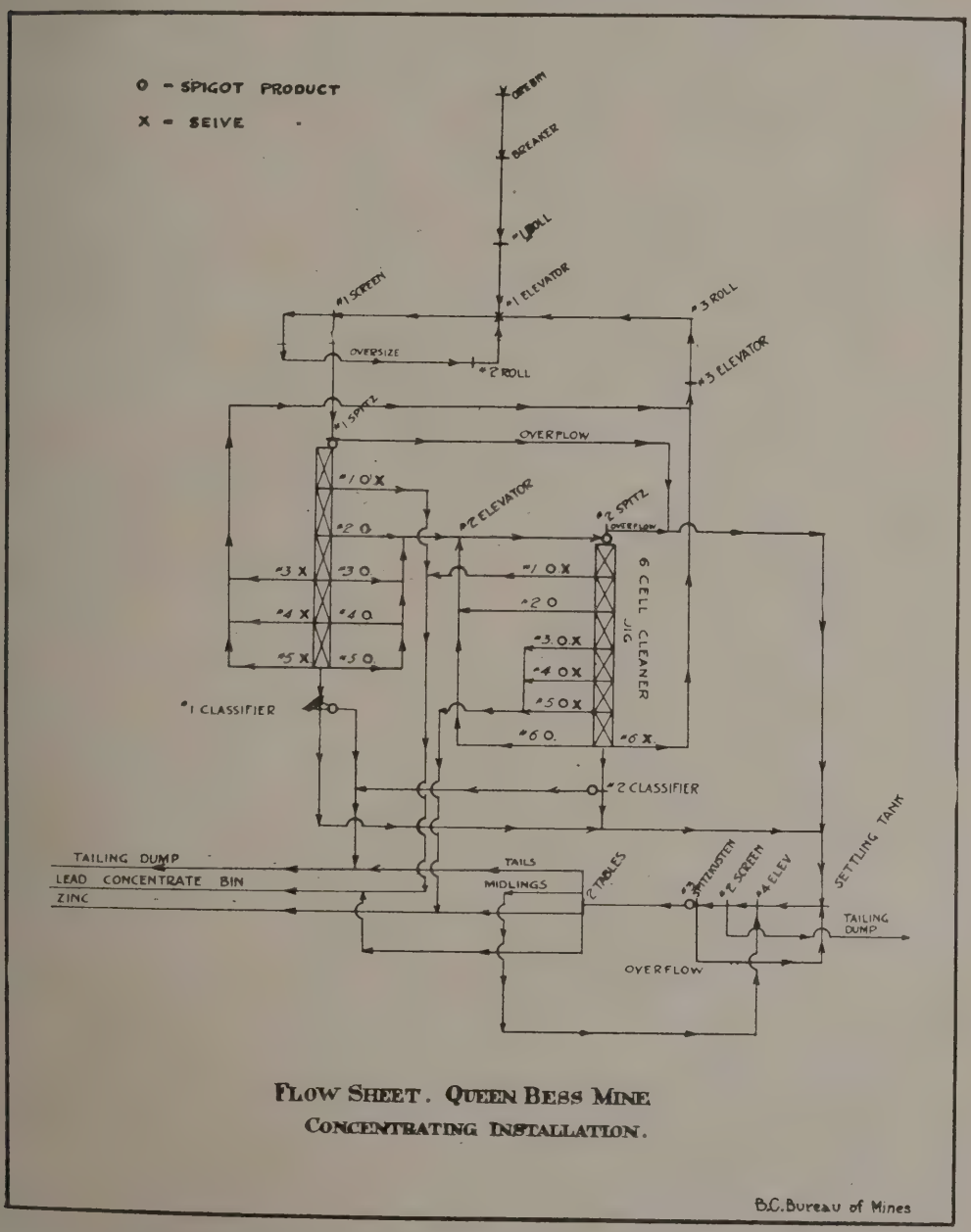
Queen Bess Mines Co. President and manager, O. A. Thomas, Hoge Building, Seattle; resident secretary, C. E. Max, Kamloops, B.C. The property being operated under bond by this company comprises six claims situated on the east side of the North Thompson river and adjoining the Canadian Northern Railway track about two miles south of Blackpool Station. The claims are situated on the steeply inclined westerly face of the mountains which flank the east side of the North Thompson valley at this point. At the time this property was visited (January 19th, 1919) there was a considerable amount of snow on the ground, so that surface conditions could not be investigated. From evidence furnished from the underground work so far carried out, the country-rock appears to be a fine-grained compact greenstone, in which are fissures carrying a mixture of galena (silver-lead) and zinc-blende in a quartz and quartz porphyry gangue.

At an elevation of 1,000 feet above the valley a drift-tunnel (No. 2) has been run on a vein having a strike of approximately N. 28° E. (mag.). This vein varies in width from 2 to 6 feet, the latter being the width now showing in the face. The length of the drift or tunnel is 100 feet, but the vein is said to have been traced on the surface for over 350 feet.

At a vertical distance of 270 feet below No. 2 tunnel a crosscut working-tunnel running in a direction N. 70° E. (mag.) has been driven to intersect the vein at an estimated distance of 375 feet from the portal. At the time the examination was made this working-tunnel was in a distance of 265 feet, and at 255 feet a small fissure was passed through carrying mineralization similar to that in the upper workings, but it was believed that the main No. 2 lead had not been reached.

At 180 feet from the portal in the working-tunnel a fissure was intersected having the same strike as that referred to as No. 2, and dipping north-westerly about 70 degrees. This crosses

the main tunnel at an angle of 45 degrees. A drift southerly has been run on this for a distance of 50 feet; the mineralization in this face is not particularly strong. The northerly drift, which was in a distance of 35 feet, showed a 6-foot fissure in the face, having 2 feet of high-grade ore on the hanging-wall side; next 2 feet quartz carrying scattered mineral; then 2 feet of so-called porphyry, but which has more the appearance of crushed and altered country-rock.



Flow Sheet. Queen Bess Mine
Concentrating Installation.

B.C. Bureau of Mines

The management, believing there was sufficient ore in sight to warrant the erection of a concentrating plant, has during the past summer, and after having exhaustive tests of the ore made by the Faust Company, of Vancouver, erected a plant having a capacity of 50 tons of ore in twenty-four hours. This plant is a replica of the one erected at the *Silver Standard* mine near Hazelton and is a Faust installation throughout—crusher, rolls, jigs, and slimes-tables.

The power is supplied by a boiler burning wood or coal of sufficient capacity to take care of a small compressor plant when it is thought advisable to install one. A considerable amount has been expended in camp buildings, consisting of superintendent's house, office, large rooming-house with dining-room, kitchen, and reading-room, also several cottages for married quarters. The concentrating plant started operations early in February, 1919.

Homestake. Situated three miles west of Adams lake, on the north side of Pass creek. (*See* Report of Minister of Mines, 1917, page 221.) This property has recently been bonded to Eastern interests and is being developed under the local management of H. D. Cameron, Blucher Hall Post-office, B.C. A camp capable of accommodating a dozen men has been erected and hand-development is now proceeding, with, it is said, satisfactory results.

Zinc Zone. Situated on the west shore of Adams lake, about fourteen miles above Adams Lake Post-office; owner, George L. Breeden, Kamloops. The mineralization on this claim is with zinc-blende. It occurs in a bed of the Pre-Cambrian Tshinakin limestone of the Adams Lake series. The occurrence can be traced along the shore of the lake just above the water-level for a considerable distance; it appears to dip to the north-west away from the lake at an angle between 10 and 15 degrees. An open-cut which was started as a shaft to test the depth of the occurrence, but which was really crosscutting the mineralized bed, shows it at this point to be about 5 feet in thickness. A sample taken across 18 inches next the foot-wall, and which was much more highly mineralized than the overlying portion, gave on assay at the Provincial Assay Office 22 per cent. zinc. Practically no work has been done on this claim. The ore would be easily amenable to concentration.

Copper King and Camp McLeod Groups. Situated on Seymour river. (*See* report by W. M. Brewer in Report of Minister of Mines, 1913, pages 202-203.) On account of the Granby Company doing a very considerable amount of exploratory work on these properties the Government assisted in the construction of a trail from the head of Seymour arm. During the season this was completed, with the exception of about two miles, which will no doubt be finished in the spring. Diamond-drilling was carried on during the past summer, and it is intended to resume operations again when weather conditions are favourable.

Maxine Group.—Situated on north shore of Kamloops lake. (*See* report by W. M. Brewer, Minister of Mines' Report, 1915, page 216.) Very little work has been done on this property during the year. About 20 tons of ore was shipped.

Tenderfoot.—Situated near Copper creek, on north shore of Kamloops lake. (*See* report by W. M. Brewer, Minister of Mines' Report, 1913, page 196.) A small amount of development-work has been done on this claim during the past summer. No ore was shipped.

Fortuna Group. Situated about ten miles east of Louis Creek Station, Canadian Northern Railway, near Blucher Hall Post-office; owner, G. N. Richmond, of Philadelphia. The ore on these claims is an iron pyrite, said to contain small amounts of metals of the Platinum group, although some assayers to whom samples were submitted could not get results, others claimed returns of 0.2 to 0.3 oz. of platinum a ton. Early in the year two car-loads of the ore was shipped to Republic, Wash., for treatment. The returns from this shipment are not available. No work has been done at the mine since the shipments referred to were made.

Glen Iron-mine. Situated on Cherry bluff, near Cherry Creek Station, Canadian Pacific Railway, on south shore of Kamloops lake. Although this property has not been worked for a considerable number of years, in view of the interest that is being taken in the matter of the iron-ore resources of the Province a few notes on it may not be out of place. This property was reported on by Dr. G. M. Dawson as far back as 1877, by McEvoy in 1892, and again by Dawson in 1894. Of more recent date is a report by W. M. Brewer appearing in the Report of the Minister of Mines, 1913, page 184.

On September 11th, 1918, a visit was made to this property, but conditions were not favourable for a satisfactory examination, the shaft in the lower workings near the Canadian Pacific Railway track being full of water and the tunnel at the upper workings being inacccessible, the slide-rock from the open-cut workings above having filled the mouth. From the large number of outcrops observed occurring over and within an area of at least 2,000 feet in diameter, it is obvious that there must be in the aggregate a large tonnage of high-grade magnetite; however,

it would be premature to attempt an estimate of "ore in sight" or "probable ore" before the sizes of some of these lenticular masses, both laterally and in depth, have been proved to some extent by diamond-drilling or some other method of development. Besides the high-grade or clean ore, there appears to be quite considerable bodies of magnetite associated with lime and feldspathic material and mixed with the country-rock which could be cheaply concentrated by magnetic separation.

I think there is no doubt that when the steel and iron industry in British Columbia has reached the stage where local requirements warrant the working of domestic deposits, the Cherry Bluff vicinity will form a not insignificant reserve to meet these demands. A sample was taken across an 8-foot face in the open-cut above the tunnel at the upper workings, and gave on analysis at the Provincial Assay Office: Iron, 61 per cent.; silica, 1.50 per cent.; sulphur, trace.

Cinnabar-mercury.

In the C.G.S. Summary, 1912, page 145, the following note by C. W. Drysdale occurs: "In the vicinity of Copper creek, Kamloops lake, occur deposits of cinnabar which have not been worked since 1897. The cinnabar occurs in irregular veins traversing a grey feldspathic and dolomitic rock which readily weathers to a yellowish colour. The country-rock is an altered greenstone containing pyroxene and olivine. The cinnabar is associated with small quantities of stibnite and has a calcite and quartz gangue. The mines have produced over 7,000 lb. of mercury. It is said that 150 tons of ore produced 114 flasks of mercury valued at £900."

During the past summer (1918) an examination of this property was made by Charles Camsell; his report will doubtless appear in the C.G.S. Annual Summary.

ASHCROFT MINING DIVISION.

The only development of interest or magnitude that has taken place in this Division during the year is that in connection with the epsomite or magnesium-sulphate deposits. There has been no development-work done on the copper properties in Highland valley; this condition probably being partially due to the excessive cost of carrying on such work under present conditions. The *O.K.* mine, the only shipper of any importance, has been closed down during the year.

Basque Chemical Production Company, Limited.

President, George J. Hammond, No. 509 Richard street, Vancouver, B.C. Operating epsomite or magnesium-sulphate occurrences. These comprise five small lakes situated about twelve miles in a south-westerly direction from Ashcroft and three miles and a half by wagon-road from Hammond's Spur, on the Canadian Northern Pacific Railway. No. 1 lake has an area of approximately 8 acres and No. 2 about 3 acres; the other three lakes are not of great importance.

This property was examined on March 8th, 1918, by Charles A. Newhall, of Seattle, Wash. The following extracts are from Mr. Newhall's report:—

"The examination was made on the lakes on March 8th. Considerable snow was on the ground and it was impossible to form an exact estimate as to the extent of the salts, in that we could not distinguish between the mud and the salts. In general the formation of these lakes is similar to the ones that are being worked in the district tributary to Oroville, Wash. The salts occur in pools of varying shapes and sizes; these pools being surrounded by mud-rings. The excavations made on the lakes indicate that the pools carry layers of salts to a total depth of approximately 20 feet, the salts lying in layers and intermixed with mud. These pools are more or less conical in shape, tapering off towards the bottom. In other words, the greatest area is exposed at the surface. Mud to varying depths lies between the pools, and this mud in other lakes has always been found to carry more or less salts.

"On the property examined there were five lakes, lake No. 1 being the largest. Salts were found in lakes Nos. 1, 2, 3, and 4. Only on lakes Nos. 1 and 2 was there apparently any great quantity. In the other lakes there was just a thin layer at the points sampled. However, as indicated above, our examination could not cover the whole surface of the lakes on account of the snow, and it is quite possible that there were more salts in lakes Nos. 3 and 4.

"A test-pit was put down to a depth of approximately 4 feet in lake No. 1 and samples of salts taken in the different layers. A second test-pit was put down in this lake, the salts showing in identically the same formation as in the first pit. One hole was put down in each of the other

lakes. In lake No. 2 there were a number of distinct layers of salts, and referring to the analysis below you will note that there was some variation in composition.

"All these salts are of high quality enough to work up into Epsom salts, in both U.S.P. and technical grade. The salts from lake No. 1 are particularly high grade, and the amount of impurity as shown by the 'other soluble' salts will cause little or no difficulty in refining.

"If the top layer on lakes Nos. 1 and 2 could be worked with before the water from the melting snow dissolves it, these layers would be of a shipping grade as technical salts. All the other layers of salts in all the lakes would have to be worked up in a plant, and should be freed from insoluble matter and the black mud."

Eleven samples were taken by Mr. Newhall, and the analyses of these are given in his report, but only one will be quoted here; this is from "Top layer 5 inches thick, lake No. 1," and is as follows:—

	Sample No. 1. Per Cent.
Insoluble matter	0.76
$MgSO_4$	44.58
Water	50.84
Other soluble solids	3.82
Total soluble matter	99.24
Epsom equivalent to $MgSO_4$	91.28

The property was visited by the writer on March 20th, when there was 4 inches of liquid solution over the crust on lake No. 1. It was visited again on June 25th, when the liquid had all evaporated and the crust would stand being walked over.

During the year a wagon-road has been constructed from the loading-bunkers erected at the railway siding to the property. A storehouse has been built at lake No. 1, in which 200 tons of the salts are now stored awaiting shipment, and the company is proceeding with the erection of buildings and preparation for putting in a refinery.

CHROMITE.

Six miles north of Ashcroft, on the west bank of the Bonaparte river and adjoining the Cariboo road, Phil Oppenheim, of Ashcroft, staked a claim on which he had discovered chromite. The ground is deeply covered with overburden and the exposure was discovered in a small gulch which has been washed out by freshets. A couple of small pits had been excavated in the side of the gulch, in which chromiferous ore in a serpentine rock showed up. A sample of the ore was sent to the Provincial Assay Office for assay, from which returns were: Chromic oxide, (Cr_2O_3), 10 per cent.; platinum, *nil*. This examination was made in the company of Dr. W. F. Ferrier, of the Munitions Resources Commission, Ottawa, who later had a 500-lb. sample sent to Ottawa for the purpose of having it tested as to its amenability to concentration; these results have not yet been published.

Snowstorm Group, Highland Valley.—(*See* Report of Minister of Mines, 1917, page 223.) The Department of Mines has let a contract for diamond-drilling this property. Drilling operations began the latter part of January, 1919.

NICOLA MINING DIVISION.

Practically the only activity in this Division during the past year has been in the line of coal production from the Nicola Valley coalfield. Two coal-mines, the Middlesboro Collieries and the Fleming Coal Company (old Inland Coal and Coke), have been operating. The Diamond Vale Colliery Company has done a small amount of development, opening up a new seam on the southern part of their property. A new tipple has been erected on a spur line from the railway to facilitate shipping from this recently opened seam. There is a full report by W. M. Brewer on the Nicola Valley coalfields in the Report of the Minister of Mines, 1915; this contains extracts from and references to several other reports by recognized authorities on these fields.

ASPEN GROVE COPPER CAMP.

This field covers an area of about eight miles in a north-and-south direction by two to three miles in an east-and-west. The centre of the area is approximately twenty-four miles by wagon-road south of the town of Merritt. There are 150 claims in good standing, of which sixty are

Crown-granted. This district first came into prominence about 1900, since which time there has been spasmodic attempts made at development, but no really serious work has been accomplished as yet. The mineralization is widespread and consists principally of chalcocite scattered through the volcanic country-rock, with considerable amounts of native copper in places. In a few places shafts have been sunk on fractures carrying high-grade ore consisting of native copper and chalcocite, probably largely the result of secondary enrichment. Shipments have been made from these workings, but the aggregate tonnage has not been of very great amount. The camp was reported on by W. Fleet Robertson, Provincial Mineralogist, in 1901; by A. A. Johnson, of the Canadian Geological Survey, in 1904; by J. D. Galloway, Assistant Provincial Mineralogist, in 1913; and by W. M. Brewer, M.E., in 1915. The writer spent several days in this district during the month of July. Samples were taken and forwarded to the Provincial Assay Office for assay; these results checked so closely with those published in the reports above referred to that it is considered superfluous to repeat them here, particularly as there has been no recent development-work of importance carried out.

During the past year a company was organized under the presidency of J. E. Bate, of Aspen Grove, for the purpose of consolidating sixty of the claims into one group. An option has recently been taken by Eastern interests on the holdings of this country, as well as on several other groups of claims, with the intention of thoroughly prospecting the ground by diamond-drilling. It is the intention to start operations in the spring.

Donohoe Mines, Stump Lake.—The workings at the *Joshua* shaft were unwatered early in the year to a depth of 300 feet for the purpose of having an examination made by Mr. Leedy, of Seattle. No further developments have been reported.

Mary Reynolds.—R. R. Hedley, of Nicola, has secured an option on this property and has been taking out ore and doing some development-work on the 45-foot level. Last reports mentioned 80 tons of ore on the dump, but no shipments made.

Lucky Mike. Owner, Oscar Schmidt, Nicola. Situated about ten miles slightly west of north from the town of Nicola, at an elevation of approximately 5,000 feet. Near the south-west corner of the claim is an outcropping of limestone striking in an easterly direction, but which gradually trends north until near the north-east corner of the claim the strike is in a northerly direction. Surface conditions prevented the ascertaining of the width of this limestone. The country-rock on the concave side of the outcropping limestone has the appearance of an altered diabasic rock carrying considerable amounts of epidote and calcareous matter, and has been classified in the field by some observers as an altered limestone. This country-rock carries disseminated through it considerable amounts of iron pyrites associated with chalcopyrite, in some places segregations occurring of sufficiently high value to be classified as ore.

A shaft has been sunk to a depth of 50 feet on the contact between the limestone and the country-rock; this was full of water when the examination was made, but was said to show the limestone dipping away from the concave side at an angle of about 80 degreees. A considerable amount of bornite and chalcopyrite was encountered at the contact during the sinking of the shaft. A sample taken across 15 feet of surface rock, about 300 feet from the limestone-outcrop, gave on assay at the Provincial Assay Office: Copper, 0.80 per cent.; silver, trace; gold, trace.

The first work done on this claim was in exploiting a body of ore which occurred near the north-east corner. A shipment was made from which 4.5 per cent. copper was returned; the property was then bonded and a diamond-drill put to work; the results from this went to show that this ore-body was simply an inclusion of very limited size, occurring in a trap-flow which in itself was barren.

Several claims have been staked in the neighbourhood of the *Lucky Mike*, on which showings of copper ore occur.

YALE MINING DIVISION.

Emancipation Group. This group is being operated by the Emancipation Mining Company, Limited; registered office, Room 502, Credit Foncier Building, Vancouver; manager, William Thomson, Hope, B.C. It is situated on the north-west side of the Coquihalla river and Kettle Valley Railway, about fifteen miles from the town of Hope. This property was visited on May 13th, 1918. In the Report of the Minister of Mines, 1915, page 257, Mr. Brewer gives a description of these claims and discusses the general geological

features. At the time of Mr. Brewer's report the work consisted mainly of open-cuts on a large quartz occurrence carrying low gold values. Mr. Brewer also mentions a narrower quartz lead occurring on the hanging-wall side of the larger vein and on which work had just been started.

Development-work has since been confined mainly to this narrower and richer lead. At the time the mine was visited in May a drift-tunnel had been run on this body for a distance of over 200 feet, exposing lenses of high-grade gold ore asssociated with arsenical pyrite, in some places the values extending into the wall-rock. Most of the high-grade ore encountered was shipped as the work progressed. The following statement of shipments was supplied by the manager: "1916, 3 tons netted $1,542. In 1917 C. H. Lighthall bonded the property and shipped 53 tons, which netted $18,295, afterwards throwing up the bond. Afterwards in the same year Mr. Merrick, the owner, shipped 8 tons and 40 lb., which netted $2,828.95.

"In February, 1918, a shipment of 401¾ lb., dry weight, of specially selected ore gave gross returns of 462.31 oz. of gold a ton and 87.85 oz. of silver a ton, and another shipment made at the same time of 5½ tons gave gross returns of 34.15 oz. of gold a ton and 6.50 oz. of silver a ton. The total shipments for 1918, as given in recent returns received from the manager, are: Total shipped during 1918, 19 tons, for which the Tacoma smelter gave the following returns: Gold, 458 oz., value $9,150.82; silver, 79.73 oz., value $67.98; total, $9,218.80."

In all the shipments made the relation between the amounts of silver and gold present is in the proportion, roughly, of 1 oz. of silver to 6 oz. of gold. All development-work has been carried out by hand and the ore hand-sorted.

This property is situated in the same mineral belt as the *Emigrant* mine, situated about seven miles north-westerly on Siwash creek. The intervening ground has all been staked and good ore is reported to have been discovered on several of the claims. The country-rock of this mineralized zone may be described generally as slaty argillite, in which occur lenticular or ledge-like occurrences of quartz, with which the gold is associated.

Emigrant Group.

(*See* Report of Minister of Mines, 1917, page 226.) This property was not visited during 1918. The Mining Recorder at Yale reports that active development has continued throughout the year under the management of Mr. Wilson. Reduction machinery has been forwarded to the mine, and it is expected that this will be erected and gold production begin during the coming season.

Aufeas Gold Mining Co.—(*See* report by W. M. Brewer in Report of Minister of Mines, 1915, page 255.) This company has not been operating for some little time, but during the summer of 1918 a small staff of men was engaged putting in a cable-tramway from the tunnel to the road.

River Gold Recovery Co.—This company has been operating on a placer proposition on the Fraser river about half a mile below the town of Hope, using a Roberts rotary gold-saving machine for recovering the gold. No returns are available in regard to the results of the season's work.

Considerable prospecting has been going on in this Division during the year and several finds have ben vaguely reported, but nothing sufficiently definite has been brought to my notice to warrant further mention.

Queen Bess Mine, looking down North Thompson River.

Ida May Mine, New Mill, looking West.

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LILLOOET DISTRICT.

LILLOOET MINING DIVISION.

Report of John Dunlop, Gold Commissioner.

I have the honour to submit the annual report on the progress of mining in Lillooet Mining Division during the year 1918.

Mineral Claims.

In the Cadwallader subsection of Bridge River section the recovery of gold by mining and milling process, owing to scarcity of labour and other causes, does not quite compare with results obtained in former years; in fact, milling of ore ceased for a considerable period, but was resumed late in the fall. Development-work, however, was maintained throughout the year.

Pioneer Mine.—Shaft was sunk to the 300-foot level; the ledge tapped there was found to be wider and richer than in the upper levels. One sample lot taken from the drift on the 300-foot level yielded $46.99 in gold to the ton, and 75 tons of ore milled gave a return of $3,510 in gold. Altogether this mine treated during the season 3,248 tons of quartz and the bullion returns for the year are placed at $37,921.

Lorne Mine.—This mine has been practically closed the greater part of the working season through the scarcity of labour, except for a short time, during which 380 tons of ore was treated. The stamp-mill has been idle, the management utilizing the limited help in development-work. The work done consisted of tunnel extensions, crosscutting, and upraise, also building addition to tram line.

Ida May Mine.—The operating syndicate erected a Huntingdon mill on the ground, and it is expected that milling operations will commence next season. Some development-work was done, but I have no information as to the character of the work performed.

Wayside Mine.—Work during the past year was confined to extending tunnel No. 4, the face of which is now advanced 700 feet from the portal. Character of ore is not changed, although lenses of good ore have been encountered; the mass of the filling remains non-siliceous. The chief object in driving ahead and following the contact of the No. 4 with the No. 3 ledge is not yet attained, though it is expected to be cut a few feet ahead of present face. The management deserves every credit for its perseverance and staying qualities.

Gun Creek.

Apart from the annual assessment-work done by the owners of mineral claims in and around Copper mountain and the extension of the trail, commenced the previous year, there is but little to comment upon. I understand that a member of the Dominion Geological Survey visited this section during the year.

Tenquille Creek.

The above remarks apply also to this section. Quite a number of the locations are bonded, and a trail was commenced which will greatly aid in reducing cost of transportation of supplies and be an incentive to development-work.

Placer-mining.

Mining leases remained inactive. Golden Dream Company is organizing and intends to resume operations early in 1919. The Lillooet (B.C) Mining Company is planning in the same direction, in view of the cessation of war.

The recovery of gold by the individual miner, including Indians, for the past season is the lowest on record—namely, $350.

Office Statistics—Lillooet Mining Division.

Free miners' certificates issued	172
Mineral claims recorded	191
Certificates of work recorded	300
Placer claims recorded and rerecorded	5
Mining leases in force	34
Conveyances, etc., recorded	52

Revenue.

Free miners' certificates	$1,047 75
Mining receipts, general	2,185 75
Tax, Crown-granted mineral claims	816 50

CLINTON MINING DIVISION.

REPORT OF G. MILBURN, GOLD COMMISSIONER.

I have the honour to submit the annual report of the Clinton Mining Division of Lillooet District for the year ending December 31st, 1918.

During the past year there was probably greater activity in the mining industry than ever before, both in regard to development-work and location of new claims.

In the vicinity of Clinton the Epsom-salts lake, which is embraced by two Crown-granted mineral claims, developed in the hands of the Stewart-Calvert Company, Inc., into a shipping proposition. Four cars comprising 140 tons of salts were shipped direct to distributers for use without treatment of any kind, and about 1,200 tons were collected for shipment to the company's refinery at Oroville, Wash. I understand an estimate places the total of salts collectable from the lake at about 10,000 tons, and that when that quantity is removed this source of supply will be exhausted for many years to come.

The Pacific Coast Contractors, Limited, have erected and put into use, in connection with their soda claims near the 70-Mile House, equipment for the extraction of the soda. I understand that one car-load was shipped and that a further quantity is ready for shipment.

C. E. Cartwright, who during the year staked a large number of claims adjoining the town of Clinton on the east, has been continuously doing development-work on them, and has driven a tunnel facing the town to a depth of about 100 feet. He informs me that he intends to put in a diamond-drill in the future in order to ascertain as quickly as possible the extent of the magnesite-deposit. Mr. Cartwright also has done development-work on his claims near Kelly lake, and will during the coming year continue the work in the expectation of developing a gypsum industry.

The claims on Scottie creek have been worked during the year with a small pay-roll, and upwards of 500 tons of chrome-iron ore has been mined and is ready for shipment.

All the above-mentioned claims are within easy reach of the Pacific Great Eastern Railway and are receiving attention because of the nearness of transportation.

The claims at Chilko lake referred to in last year's report were further developed during the season, but I am unable to say anything as to results obtained.

From the office statistics will be seen that nearly eight times as many mineral claims were recorded this year as compared with the previous year. Several considerable groups of claims were located, three of which are situated in the vicinity of Clinton and one near the northern boundary of the district.

Two of the groups near Clinton and that near the northern boundary were located for magnesite, and the other one, near Clinton, I was given to understand, was a nickel proposition. No development-work has as yet been done on the latter group, which was recorded about July last.

There has been practically no placer-mining activity, owing to some extent to the enlistment of some of the miners. However, one placer-mining lease on Watson Bar creek was applied for, and it is likely that the usual limited activities will be resumed this year.

OFFICE STATISTICS—CLINTON MINING DIVISION.

Free miners' certificates	124
Mineral claims recorded	313
Placer claims recorded and rerecorded	16
Certificates of work	27
Dredging leases in force	14
Placer-mining lease applied for	1
Transfers and agreements recorded	52
Crown grants issued	2

Revenue.

Free miners' certificates	$ 48 25
Mining receipts	1,155 30
Total	$1,636 55

CLINTON MINING DIVISION.

NOTE BY PROVINCIAL MINERALOGIST.

HYDROMAGNESITE DEPOSITS.

The following notes regarding these deposits, situated near the 105-Mile House on Cariboo road, have been received from one of the owners:—

The 105-Mile House deposit is estimated to contain about 100,000 tons of hydromagnesite, of which it is considered that 50,000 tons will prove to have a purity equal to the following analysis:—

After heating to a temperature of 100° C.—

Silica	0.76
Magnesium oxide	2.24
Ferric oxide	0.04
Alumina	0.49
Lime	*Nil*
Magnesium carbonate basic	96.47, equiv. 44.52 MgO.
Ignition loss	50.65

The moisture content will vary from 20 per cent. in the spring and fall to practically *nil* in the summer-time.

The material obtains in a very finely divided form in beds which vary in thickness of composition; in some cases giving only a couple of feet of the purest white material, while in other cases the material remains the same for a depth of 7 feet. As, however, it can easily be bored by means of a post-hole auger, it is not difficult to test for quantity. At a depth of 5 feet water is struck, and this water appears to be very full of gas, but is most palatable. In most cases the hydromagnesite is quite noticeable on the surface of the ground, as it generally shows white, bare surfaces with no vegetation; but I have found at other places it is not observable on the surface, having been covered at a date subsequent to its deposition with a surface wash of alluvial soil. Beneath the fine white material this deposit, in general, shows a yellowish-tinged material of a more granulated form and which appears to hold more impurities.

The Chilcotin deposit appears to be considerably larger in extent, but has not been tested out to any extent.

Although there should be some market for this material in its crude state, the main market seems to be for the calcined product. Owing to this material being in a fine powdered form and very light it was a difficult matter to find a suitable form of calciner to treat the material. We think this difficulty has now been solved, with a resulting product which will be superior to the rock-made article, as it will have a greater purity and a greater uniformity in its calcination, and at the same time be of a finer character. This will place it in a class by itself, far ahead of anything now on the market for the manufacture of sorel-cement and kindred processes, and it will be of a sufficient purity to be used for all usual chemical purposes without using the costly process now required to obtain that purity. The use of magnesite flooring, stucco, imitation marble, etc., is being extensively developed and will augment the growing market for the purest material of a fine texture; while the usual uses for refractories in the form of plaster, brick, and for insulation of steam-pipes, etc., will always afford a steady demand. Unfortunately, owing to the prohibitive duty of $70 a ton on the calcined article, to reach the United States market, the raw product will have to be treated in the United States, as there is no duty on the raw material. It is now a question if the Canadian market will warrant the erection of a plant to supply the domestic market alone.

It is a difficult matter to ascertain the names of the users of this class of material, and therefore it is not possible to find out what quantity is required per annum in Canada. Last year from one inquirer alone in the United States I could have marketed 7,000 tons of the calcined material at a very high price. There also must be a market for the crude material in considerable quantity if only it could be located in Canada.

YALE DISTRICT.

NICOLA MINING DIVISION.

REPORT OF J. A. MURCHISON, MINING RECORDER.

I have the honour to submit herewith the annual report and office statistics of the Nicola Mining Division for the year ending December 31st, 1918.

Owing to the adverse economic conditions prevailing there has been no extensive development-work on any of the groups of mines.

TEN-MILE CREEK.

Aberdeen. This mine has not been operated during the current year, but I am informed by Thomas J. Corwin, of Vancouver, that development-work is to be resumed shortly, and that a mill is to be installed on the property. About 1,600 tons of ore, averaging 6½ per cent. copper, has been shipped from this property, which is situated on the Ten-mile creek about ten miles from Coyle Station, on the Kettle Valley Railway.

ASPEN GROVE.

Aspen Grove Amalgamated Mines, Ltd.—American capitalists have secured an option on this company's sixty copper claims in the Aspen Grove district, and it is the intention to thoroughly prospect this property with diamond-drills so soon as weather conditions will permit.

STUMP LAKE.

Donohoe. This group of claims is owned by the Donohoe Mines Corporation. Frank M. Hawkes, of Seattle, informs me that active development-work is to be resumed on this property as soon as circumstances will permit. This company's holdings now comprise eight Crown-granted mineral claims and a number of recent locations. When the necessary machinery to allow of economical mining has been installed, it is confidently expected that this mine will become a large producer.

Mary Reynolds. A new feature of interest in this district is the resuming of operations at the *Mary Reynolds* mine after a term of thirty years of inactivity. This property, which is situated near the Donohoe mines at Stump lake, and which is said to carry good averages in silver and gold, is being operated, under option of purchase, by Robert R. Hedley, a mining engineer, of this place.

COUTLEE-JUNIPER MOUNTAIN AND IRON MOUNTAIN IRON-DEPOSITS.

During the current year an increased interest has been taken in the iron-deposits of this district, and it now appears altogether likely that concentrations may be discovered which will eventually lead up to a profitable iron industry. The iron interests are as follows:—

Coutlee Group.—F. C. Porter *et al.*, of Vancouver, with claims at Coutlee.

Titanic Group.—W. H. Boothroyd *et al.*, of Merritt, with claims on Juniper mountain.

Fairview Group.—F. M. Warner *et al.*, of Merritt, with claims on Juniper mountain.

Iron Dollar Group.—Emmett Todd *et al.*, of Merritt, with claims on Iron mountain.

OFFICE STATISTICS—NICOLA MINING DIVISION.

Locations recorded	109
Free miners' certificates	116
Certificates of work	150
Bills of sale	11

YALE MINING DIVISION.

Report of H. Beech, Mining Recorder.

I have the honour to submit the annual mining report and office statistics for the year ending December 31st, 1918.

Placer-mining.

This branch of mining has been neglected in this Division of late years, but eventually, with improved methods, the fine gold in the river-bottoms will be recovered. The only company at present at work is the River Gold Recovery Company, Limited, which installed machinery for the saving of gold values on the banks and in the bed of the Fraser river; about twelve men are employed. As numerous inquiries are being made as to placer-ground between Hope and Yale, it is quite possible that other companies will make an attempt to recover the gold known to exist.

Lode-mining.

Altogether the year has been one of great promise, and many of the properties have reached a stage which justifies a large expenditure of capital. This will be forthcoming at an early date, no doubt, now that the war is over and mining resumes its normal activity.

The *Emancipation* group, owned by the Emancipation Mining Company, has been a regular shipper during the year. The manager reports the total tonnage and values shipped in 1918 as 18½ tons, which was sent to the smelter at Tacoma, and yielded 457½ oz. of gold, valued at $9,150.82; silver, 79 oz., value, $67.98; or a total of $9,218.80 from 18½ tons of ore. This output should ensure particular attention to this district, which has been kept back by discouraging reports.

On the same lead as the *Emancipation*, on claims for a distance of six miles, considerable excitement was caused early in the year by the discovery of free gold in the outcrops. The country between the *Emancipation* and the *Emigrant* group is now staked solid for a distance of eight miles. The past year has been the most promising since the district was first opened.

The Aufeas Gold Mining Company has had a few men at work on its claims and has put in a tramway for the handling of ore and supplies.

The 23-Mile district, on the Hope-Princeton trail, has kept a number of prospectors busy during the year, but owing to lack of transportation facilities the district is being retarded.

Prospecting the country on the headwaters of Peers and Dewdney creeks has been helped considerably by the erection of the new foot-bridge across the Coquihalla river. This section is rich in mineralized country and will no doubt be opened up in the near future.

The *Emigrant* group, on Siwash creek, has had men at work under the management of Mr. Wilson, mostly on development-work and preparation for ore-treating machinery. The ore-showings have been very encouraging and the district is being staked by prospectors.

The Gold Creek Mining and Development Company, Limited, which owns mining property near Spuzzum, is continuing development-work under the management of A. A. Macdonald, who recently reported the opening-up of good milling-ore.

Office Statistics—Yale Mining Division.

Free miners' certificates issued	144
Special certificates issued	*Nil*
Locations recorded	152
Certificates of work issued	137
Bills of sale, etc., recorded	48

Revenue.

Free miners' certificates	$1,022 00
Mining receipts, general	1,018 85
Revenue, other sources	149 50

ASHCROFT MINING DIVISION.

REPORT OF H. P. CHRISTIE, MINING RECORDER.

I have the honour to submit my annual report as Mining Recorder for the Ashcroft Mining Division for the year 1918.

The situation remains unchanged since my last report. The annual assessment-work has been done on practically all the old claims. I understand the Resident Mining Engineer is making a more detailed and extensive report.

OFFICE STATISTICS—ASHCROFT MINING DIVISION.

New locations recorded	179
Certificates of work	104
Conveyances, etc.	40
Free miners' certificates issued	102

KAMLOOPS MINING DIVISION.

REPORT OF E. FISHER, GOLD COMMISSIONER.

I have the honour to submit the annual report on the Kamloops Mining Division for the year ending December 31st, 1918.

The past year has shown a considerable falling-off in the number of claims located in this Division as compared with the preceding year; but, on the other hand, there has been steady progress in development-work, as is evidenced by the number of certificates of work issued, which show an increase of 10 per cent. over the number issued in 1917.

The principal mining operations have been at the *Iron Mask* mine, *Lydia* group, *Queen Bess* mines, and the *Homestake* group, full particulars of which are covered in the report of R. W. Thomson, District Engineer. Except for three placer claims which were recorded on Louis creek, and on which no work was done, there has been no activity in the way of placer-mining.

OFFICE STATISTICS—KAMLOOPS MINING DIVISION.

Free miners' certificates	340
Mineral claims recorded	167
Certificates of work issued	202
Placer claims recorded	3
Bills of sale	30

Revenue.

Mining receipts	$3,168 00
Mineral-tax collected	655 18

WESTERN DISTRICT (No. 6).

REPORT BY WM. M. BREWER, RESIDENT ENGINEER.

OUTLINE OF REPORT.

It is unnecessary to repeat the description of the boundaries of the Western Mineral Survey District, as these were published in the Annual Report for 1917.

For convenience in designating the location within the various Mining Divisions in which the groups of mineral claims are located, it has been deemed advisable to divide each Mining Division into sections. These sections are as follows:—

Name of Mining Division.	Section.	Subsection.
Alberni	Alberni Canal.	
	Barkley Sound	Uchucklesit Harbour.
		Copper Island.
		Hawkins Island.
		Henderson Lake.
	Great Central Lake.	
Clayoquot	Tofino Inlet	Kennedy Lake.
		Deer Creek.
	Central West Coast	Bedwell Sound.
		Ahousat.
		Sidney Inlet.
		Nootka Sound.
Quatsino	South-east Arm	Elk Lake.
		South-east Arm.
	West Arm.	
Nanaimo	Strathcona	Buttle Lake.
		Quinsam Lake.
	Salmon River.	
	Quadra Island.	
	Phillips Arm.	
	Texada Island.	
	Redonda Island.	
	Comox.	
	Cumberland.	
	Nanaimo	Cassidy.
		Nanoose.
Victoria	East Sooke.	
	Jordan River.	
	Saltspring Island.	
	Cowichan Lake.	
Vancouver	Britannia Belt.	
	Lynn Creek.	
	P.G.E. Rly.	Alta Lake.
		Cheakamus Lake.
New Westminster	Cheam Range.	
	Agassiz.	
	Stave River.	

In the following report a description of the properties examined during the season of 1918 is given under the head of the section in the Mining Division in which the properties are located.

The progress in the mining industry in the Western Mineral Survey District was quite satisfactory during the first nine months of the year 1918, but during the last quarter of the year the production in both the coal and metalliferous mines fell off to a marked degree, owing to the influenza epidemic which prevailed throughout this district. The working forces during October and November last in all of the producing mines were reduced by at least one-third, and for a portion of the time only about 50 per cent. of the miners reported for work.

In portions of the district there were quite a few prospectors in the field during most of the year, but the number was not as great as during 1917. The question as to what means is best to pursue to encourage more interest in the exploration of the practically unknown parts of the district is a very difficult one to solve. The University of British Columbia as well as the Chamber of Mines have endeavoured to encourage men, and especially returned soldiers, to adopt prospecting as an occupation, by giving a short course of lectures on the subjects pertaining to the mining industry, which have been taken advantage of by several miners and others. Possibly during the coming season satisfactory results will be observed from these efforts.

Nature has placed serious obstacles in the way of the prospector, such as a dense growth of underbrush, fallen timber, etc.; yet these difficulties are not insurmountable, as was proven by very many prospectors who have been successful in making good stakes as the results of their explorations. This subject is mentioned in this report to encourage more men to take up the occupation, which, despite the hardships, is one of the most fascinating employments a man can engage in.

There are approximately 2,000 metalliferous mineral claims in good standing in the Western Mineral District, of which number about one-half are Crown-granted. More than 25 per cent. of the claims are located in the Vancouver Mining Division, the majority of which are situated between Britannia Beach, on Howe sound, and the Indian river, which flows into the North arm of Burrard inlet.

An important event in the Vancouver Mining Division in 1918 was the purchase by the Britannia Mining and Smelting Company of the *Roy* group of mineral claims, situated on the east side of the Indian river, which property was acquired from Geo. McLeod and associates. The same company also bonded several other groups in the same locality, as well as acquiring by staking a number of claims between Loch Lomond, the source of Seymour creek, and the west side of the Indian river, thus forming a connecting-link between the company's former holdings and the Indian River district. Eventually the entire property can be connected by a tunnel from Britannia Beach to the east side of Indian river, should development prove that such a course is advisable. The distance from Britannia Beach to Indian river in a direct line is about twelve miles. The general manager, J. W. D. Moodie, has informed the writer that the cost to the company for the mineral claims acquired outside of the original holdings of the old Britannia Copper Syndicate has been approximately $1,500,000.

The discovery of oil-seepages on Still creek and in the peat marshes near Burnaby lake gave a very decided impetus to operations in exploring for oil in that vicinity. The Spartan Oil Company, Limited, was organized in 1918. W. R. Jewell, Kansas City, U.S. geologist and petroleum engineer, was consulted, and after an examination advised boring with diamond-drill, which advice was followed and the results are referred to later in this report.

The desire of the Imperial and Dominion Governments to obtain supplies of manganese, molybdenite, chrome ore, bauxite, and other war minerals encouraged a few prospectors in this district to search for occurrences of such minerals. The results were that about twelve mineral claims, on which a good grade of manganese ore occurs, were located in the vicinity of Cowichan lake, Vancouver island, and several occurrences of molybdenite ore were found on Buttle mountain, near Cowichan lake, as well as on the Mainland. Unfortunately for the discoverers, none of the deposits were developed to a shipping stage previous to the signing of the armistice.

There was a notable advance made in new development-work in the coal-mining sections in the Western District during 1918, and new mines were brought into the shipping class, while others are being equipped to produce coal early in 1919. At some other places within the coal-bearing formation prospecting with diamond-drills is being done.

The progress in the metalliferous mines was satisfactory, especially at the *Britannia*, *Marble Bay* and *Sunloch* mines, a description of which with others will be found later in this report.

The production of copper from the Southern Coast section of the Western District was greater than that for any previous year by about 2,500,000 lb. This gratifying showing is accounted for by the increased production from the *Britannia* mine.

The production of gold from the Western Survey District was also greater in 1918 than in 1917, which is accounted for by the increased production of copper-gold ores, because practically all of the gold produced is found associated with the copper in the ores mined in the district, as there are at present no mines being operated which produce ores carrying values in gold exclusively.

The labour conditions in the district were satisfactory during 1918; the wages were the highest ever paid in both the coal and metalliferous mines, and there were no labour troubles that resulted in strikes, although some were threatened, but the questions in dispute were settled by conferences between the employers, employees, and Government officials.

The smelter facilities on the Coast have been curtailed since the Ladysmith smelter closed down during the summer of 1918, after being in operation intermittently from the spring of 1917, when the property was acquired by the Ladysmith Smelting Corporation, Limited.

Shipments of about 1,000 tons of magnetite from the *Good Hope* mine on Raven bay, on the east coast of Texada island, and about the same quantity of bog-iron ore from Mons, on the Pacific Great Eastern Railway, were made to the Irondale blast-furnace in the State of Washington.

BIBLIOGRAPHY.

In the Annual Report for 1917 a full bibliography pertaining to the Western Mineral District published previously to that date appeared on pages 239-241, so that it is not necessary to repeat in the present report, but only to add the publications that have been published during the past year, which are as follows:—

Summary Report, Geological Survey, Canada, 1917, Parts B. Reconnaissance along the Pacific Great Eastern Railway between Squamish and Lillooet, also Indian River Copper Deposits, Vancouver Mining Division.

Robertson, Wm. Fleet, Prov. Mineralogist. Preliminary Review and Estimate of Mineral Production, 1918. Bull. No. 1, British Columbia Department of Mines, 1919.

Stansfield, Alfred, D.Sc., A.R.S.M., F.R.S.C. The Commercial Feasibility of the Electric Smelting of Iron Ores in B.C. British Columbia Department of Mines, Bull. No. 2, 1919.

INTRODUCTION.

In introducing this, the second annual report on the Western Mineral Survey District, B.C., the writer desires to acknowledge the uniform courtesy he has received at all times, especially in the field-work, from the owners of the properties he has examined. He is indebted for many favours to the prospectors and mining men in his district, for which he takes this opportunity to extend his thanks. He is also indebted to the officials of the staff of the Branch of the Geological Survey for many favours and assistance.

The work done during the past year includes examinations of fifty groups of mineral claims. In doing this work every Mining Division in the district was visited several times, and as far as possible the properties selected for examination were those of which little, if any, information has previously been published.

Although there are, as stated in the "Outline of Report," about 2,000 mineral claims in good standing in the Western District, these are grouped into about 150 groups for the purpose of doing assessment-work on one claim in the group to apply on all previous to procuring a Crown grant; consequently a large proportion of the total number of claims have no development-work done on them and their commercial value is problematical.

During the summer of 1918 considerable time was occupied in rendering assistance to Dr. Stansfield in his investigations as to the feasibility of the electric smelting of the magnetite ores of Vancouver and adjacent islands. Large samples of magnetite from the west coast of Texada island were shipped to Dr. Stansfield, Montreal, and to the Noble Electric Steel Company, Heroult, Cal., for experimental purposes.

It is gratifying to be able to state that there have been only three cases reported in the Western District during 1918 where attempts have been made of encouraging wild-catting or promoting mining companies with alleged fraudulent intent. One of these cases was brought before the Courts in Vancouver and the principals sentenced to the penitentiary.

Late during the summer of 1918 representations were made of an important discovery of platinum at the head of Jervis inlet, but an examination by G. C. McKenzie, of the Canadian Department of Mines, proved that the reported discovery had no commercial value. Mr. McKenzie also made more than one examination of the occurrences of manganese ore near Cowichan lake, and was so much interested that, in conjunction with Wm. Fleet Robertson, Provincial Mineralogist, he recommended the properties to the Dominion Government Munitions Board, but the armistice was signed before any action by the Government was taken, and consequently the properties have not been developed owing to the lack of a market at the present time.

As a fairly complete history of the early progress of the mining industry in the Western District was published in the Annual Report of the Minister of Mines for 1917, it is unnecessary to refer to that subject again in the present report.

The district has only been scratched over so far by prospecting, and presents an excellent field for the prospector who is willing to work intelligently and is not afraid of tackling a few difficulties. The prospector who attempts to search for mineral deposits through the Western Mineral Survey District should be accustomed to the water, a fair boatman, know how to handle a canoe, be able to use an axe, crosscut saw, a rifle, and fishing-rod. The various lakes, sounds, and inlets, where the several bays afford protection and shelter in case of storms, provide unsurpassed transportation facilities as well as excellent fish-food.

There is an old saying amongst the Coast prospectors that "when the tide is out the table is spread"; in other words, all a man need do is to go out at low tide and dig clams and he will never be hungry.

FAVOURABLE DISTRICTS TO PROSPECT.

The most attractive sections for prospecting, in my judgment, are on the borders of the Coast range of mountains on the Mainland and sections of the west coast of Vancouver island. With regard to the Coast range, it has become recognized by geologists that the idea which prevailed some years back to the effect that the Coast mountains are made up entirely of a great mass of eruptive rock, mainly granodiorite, is incorrect, or as Camsell says in his Summary Report for 1917: "Investigations during the past season have shown that in the section across the Coast mountains along the Pacific Great Eastern Railway such a simple condition does not exist, but instead there are several broad bands of stratified rocks—schists, quartzites, argillites, and limestones—which lie in the granodiorite, and have been intruded by it. These bands are remnants of the old cover of the granodiorite batholith, which were not destroyed at the time of intrusion nor removed by later erosion. They all strike parallel with the trend of the range, and consequently their greatest dimension is in a north-westerly direction and their shortest along the line of the railway. The contacts of these bands of stratified rocks with the granodiorite are all more or less mineralized."

The bands referred to by Camsell occur in a zone about forty miles north-east of the Britannia zone and nearly parallel to it, where a similar condition is mentioned by McConnell in his description of the *Britannia* mine published by the Geological Survey in 1913, and if a straight-edge is laid on the map of the Coast we find that in a north-westerly course from the *Britannia* mine the line will intersect the vicinity of known mineral deposits on Jervis inlet, Powell lake, Phillips arm, Loughborough and Knight inlets.

The occurrences of the bands of stratified rocks are apparently in nearly parallel zones, with one zone extending from the vicinity of Chilliwack lake near the International Boundary toward the north-west, where it again occurs in the Cheam range near the head of Wahleach or Jones creek, and again farther to the north-west along the Pacific Great Eastern Railway, as reported by Camsell and also examined by the writer.

At the head of Wahleach creek an opportunity occurred last autumn to examine the *Lucky Four* group of mineral claims, on which an ore-body of chalcopyrite occurs in a zone of altered sedimentaries intruded by granodiorite. Last season the writer also examined several mineral claims in the section traversed by the Pacific Great Eastern Railway, where good prospects are found. One of them is the *Fitzsimmons* group near Green lake, which has been bonded by the Consolidated Mining and Smelting Company, of Trail.

For the above reasons there is no hesitation in recommending the Coast range as a good section for the prospector to explore. There are other reasons which will appeal to a prospector, one of the chief being the fact that since the original *Britannia* group was located in 1897 or 1918 the mining company has purchased about 350 claims, nearly all of which were staked by prospectors some years ago. The cost to the company for these purchases is about $1,500,000.

All of these claims are situated in what is termed the Britannia belt, and between the shore at Britannia Beach and the east side of Indian river, about twelve miles easterly from the original *Britannia* group. Of course, a large proportion of the purchased claims will probably prove of little value, but the fact that the company has made these purchases after examinations made by its engineers is evidence of the indications that extensions of the mineralized zone occur in that direction from the original group.

That being the case, it is reasonable to presume that similar occurrences of bands of stratified rocks occur on the westerly side of Howe sound in contact with the granodiorite, and that that section should be a favourable one for a prospector to explore, especially when it is considered that but comparatively little prospecting has been done in the mountains between Howe sound and Jervis inlet, or to the north-westerly from the latter.

The section in the vicinity of Loughborough inlet, Phillips arm, Bute inlet, Knight inlet, and Seymour inlet was prospected to some extent about twenty years ago, and a part of that section was then one of the active portions of the Coast District, but it has been neglected since the *Dorotha Morton* mine closed down. The fact that occurrences of bornite and chalcopyrite were discovered not very long ago in the mountains adjacent to Knight inlet suggests that the entire section is entitled to further consideration from prospectors, especially when it is considered that an ore which was practically valueless ten years ago may to-day be a commercial asset. Only recently a prominent operator informed me that he expected to see the day when he could successfully mine and treat a copper ore carrying not to exceed 1 per cent. in copper, provided the extent of the deposit was sufficiently great.

The question is often asked as to the best places for the investment of capital in mining, and the following sections of the Western District are recommended: Quadra island, Texada island, *Lucky Four* group in the Cheam range, *Big I.* group near the head of Great Central lake in the Alberni Mining Division, and the *Ptarmigan* group adjoining the *Big I.* The three last-mentioned groups of mineral claims require very large expenditure of capital to develop them, but they all promise to develop into such extensive properties as are in favour with big operators. So far as location, climate, and general surroundings with regard to costs, there are many operating properties in other mining countries which are much less favourably situated.

Texada island is another field that should attract capital. It cannot be considered, though, as a field where big low-grade ore-bodies occur, as the ore occurs in irregular bodies ranging from about 75 to 200 feet long and from a few feet to 30 feet wide, but comparatively high grade, presenting an opportunity to the mining capitalist who is looking for a property to work on a comparatively small scale where the transportation facilities are as nearly ideal as it is possible to find. The fact that the contact-metamorphic type of deposits on this island has been proven to maintain continuity to considerable depth, having been mined to a vertical depth of over 1,500 feet at the *Marble Bay* mine, should encourage mining operators to continue the development on other properties, such as the *Copper Queen*, *Cornell*, and *Little Billie*, where the ore occurs under similar geologic conditions.

On Vancouver island there are several localities where intelligent prospecting and the investment of capital should result satisfactorily; notably the East Sooke peninsula, Jordan river, the section westerly from that river near the coast-line, the mountains at the heads of the creeks which empty into Alberni canal, and the west coast of the island generally. But little real prospecting has been done on Vancouver island during the past fifteen years. Previous to that time there were about 200 prospectors exploring the mountains on the west coast, but many of these men about 1903 abandoned prospecting to stake timber claims, and a large number became fairly rich by selling out. Capital was easier to secure for purchasing timber than to develop mining properties, although many of the pioneer prospectors, whom the writer knew personally, cleaned up good stakes from their prospects.

For about twelve years, or from 1903 until about 1916, when the Coast Copper Company, a subsidiary of the Consolidated Mining and Smelting Company, of Trail, bonded the *Old Sport* group in the Quatsino Mining Division after it had been adversely reported on, there was practically no mining activity on Vancouver island, except at the *Tyee* mine on Mount Sicker, which closed down in the fall of 1907. The ores are usually low grade and will not stand direct shipment to smelters, but are well adapted to concentration by the flotation process, and after the Britannia Company installed this process some mining operators with foresight turned their attention to Vancouver island. This resulted, during 1916, in the reopening of the *Indian Chief* mine on Sidney inlet and the *Monitor* mine on Alberni canal, as well as the bonding of the *Sunloch* group on Jordan river, the *East Sooke* property at the base of Mount Maguire on the Sooke peninsula, the *Willow Grouse* in the same section, the *Blue Grouse* on Cowichan lake, as well as the *Yreka* and *Old Sport* in Quatsino Mining Division.

The above-mentioned properties were all staked by the pioneer prospectors between 1897 and 1903, except the *Sunloch* and the *Blue Grouse*, so that it is readily seen how "the prospector

has been conspicuous by his absence" during late years. In fact, it looks as though a new generation of prospectors is needed; and the question is, where shall we find them?

There are still vast areas of mountain ranges on Vancouver island unexplored; in fact, the group of mineral claims on which outcrops an ore-body of apparently considerable and possibly of about equal grade as the *Britannia*, and which is known as the *Big Interior*, is an illustration. It is about ten miles from the head of Great Central lake at an elevation of about 5,000 feet, and is, with the exception of the adjoining groups, the *Ptarmigan* and *Della*, about the only instance where prospectors have located claims on the mountain ranges in the interior of the island. The occurrence of ore on the *Ptarmigan* and *Big Interior* was discovered in 1899 in a band of altered sedimentary rocks under almost similar geologic conditions as are found at the *Britannia* mine and on the *Lucky Four* group in the Cheam range. The unexplored interior mountain ranges on Vancouver island should be attractive to the prospector. The conditions are nearly ideal with regard to travelling, for there are chains of lakes abounding in fish, such as Great Central, Sproat, Buttle, Cowichan, Cameron, Horne, and Kennedy in the central part of the island, and Alice, Victoria, Kathleen, and Nimpkish in the north-westerly part.

During 1918 the Government threw open Strathcona Park for prospectors to explore. One group of mineral claims has been located on Myra creek, and there is no reason why other outcrops of copper ores should not be found in the mountains surrounding Buttle lake of equal extent and carrying as good values as occur at the *Big Interior*.

The difficulty of transporting supplies in and hauling ore out of this section of the island has retarded its development, it is true; but each year sees vast improvements in transportation facilities, and it is only a few days since that an announcement of preparations has been made by the Esquimalt & Nanaimo Railway to extend that system from the Alberni branch into the mountains in the vicinity of Great Central lake, so that it appears as though transportation facilities on the island will be vastly improved in the future, and that a prospector need not hesitate to explore the interior mountain fastnesses because of fear that if he should find a good prospect he might have to hold on to it for many years before he could sell out to advantage, as his predecessors had to do.

ALBERNI MINING DIVISION.

Considering the scarcity of labour and absence of the usual number of prospectors, many of whom volunteered for overseas service during the war, the progress of the mining industry in the Alberni Mining Division has been satisfactory during 1918. Active development-work was done on some of the properties on Alberni canal, and a better opportunity than usual was afforded for examining the mineral claims in the Big Interior basin, owing to the fact that during the past two summers the glacier that fills the basin at the head of Della lake at an elevation of about 3,500 feet has receded to such an extent that samples could be taken at points about 50 feet lower than has ever been permissible in previous years. This condition was taken advantage of by Mr. Archibald and G. H. Kilbourne, mining engineers for the Consolidated Mining and Smelting Company, during the summer to make an examination of the *Big I.* group of mineral claims.

Alberni Canal Section.

Monitor Group. This group of mineral claims, which was described in the Annual Reports for 1916 and 1917, is again reported on because the development-work has been extended so materially during 1918 that the conditions as to the geology and structure of the ore-bodies are much better understood. The group is situated on the west side of Alberni canal, about seventeen miles below Port Alberni, and is owned by Samuel Ryder, of St. Albans, England. There are six Crown-granted mineral claims and one claim not Crown-granted in the group, containing approximately 300 acres.

Geology.—The geologic formations on the *Monitor* group are typical of very much of the geology along the west coast of Vancouver island. The rocks are for the most part igneous, which contact with metamorphosed limestone. The limestone is crystalline, with much of it altered to lime silicate and garnetite, and associated with the garnetite is epidote and hornblende. The igneous rocks are for the most part diabasic and dioritic. The rock formation is very much sheared, fissured, and faulted. Slickensided cleavage-planes are very abundant, with their lines of strike varying from about N. 40° W. (mag.) to W. (mag.), and the dips varying from about 60° S. to 80° N. The variation of the dips of the slickensides is especially noticeable in the main adit of the Leonard showing on the *Monitor No. 1 Fraction*.

The contact-metamorphic rocks on the *Monitor* group occur in well-defined zones. There are apparently two, if not three, of these zones extending along their lines of strike for several hundred feet from the shore-line of the canal into the mountains in a north-westerly direction. Bodies of copper-sulphide ore occur irregularly within the contact-metamorphic zones; sometimes the ore is found immediately at the contact between the igneous rocks and the limestone, and at other times several feet from the actual contact. The ore is generally found associated with garnetite and epidote. The width of the contact-metamorphic zone at the Leonard showing is about 75 feet on the shore-line. The width of the other zones has not been determined, as the surface is covered with brush and debris and prospecting has only been done in isolated places where the bare rock is exposed.

Characteristics of the Ore-deposits.—Occurrences of ore-bodies are found at three points on the property. These are known as the Maynard, the Hedley, and the Leonard showings. The Maynard is about 2,000 feet by aerial tramway from the canal, and is where the development-work was done in 1900-1902, from which a considerable tonnage of copper ore was shipped, averaging about 6 per cent. in copper, with low gold and silver values. The Hedley is about 1,000 feet from the canal and in close proximity to the right-of-way of the tramway. This showing was partly developed after it was discovered in 1910, and further in 1916, when about 50 tons of ore was shipped, which yielded 8.36 per cent. in copper, with low gold and silver values.

The discovery of the Leonard showing was made about the date of the shipment from the Hedley, since which time all work has been confined to the Leonard body, which apparently occurs in the contact-zone extending south-easterly from the Hedley mine-workings, but at a lower elevation of about 250 feet, and about 1,700 feet distant along the general strike of the rocks.

In the Leonard mineralized zone there had been more than one movement of the rock formation, and the shearing action has resulted in producing almost a schistose structure, with the slickensided planes very pronounced. These planes appear to have little or no influence on the occurrence of the ore, for where such planes have been followed in the main adit it is seldom that they form walls of an ore-body, although in places ore is found along what may be called the main plane, which was considered to be the south-west boundary or hanging-wall of a lens of copper ore in magnetite, with outcroppings at the portal of the adit. A short distance, though, from the portal all ore disappeared in the adit, and it was only after crosscutting about 15 feet—crosscut No. 1—to the north-east that any more was found. This ore is chalcopyrite in garnetite gangue. The general course of the adit is about N. 70° W. (mag.), and the strike of the ore-body in the crosscut is N. 40° W. (mag.), which corresponds with the strike of the contact-metamorphic country-rock outside the portal of the adit. An average sample across 2 feet of the crosscut 18 feet from the main adit assayed: Gold, trace; silver, 0.5 oz.; copper, 6.1 per cent. This was a lens of ore and has been mined out since the sample was taken. There is practically no ore remaining at this point.

The main adit was continued along the same slip or plane as it was started on, and at about 80 feet from the portal another lens of ore was exposed on the left or south-westerly side of the adit. A narrow fissure crosses the adit diagonally near this point, and at about 90 feet in from the portal there was about 2 feet of chalcopyrite on the right side of the adit which has since been mined out, a sample of which assayed: Gold, trace; silver, trace; copper, 9.6 per cent.

A short crosscut (No. 2) and an upraise (No. 1) are made on the left or south-westerly side of the main adit at a point about 80 feet from the portal. In the crosscut there occurs magnetite with impregnations of chalcopyrite for a width of about 6 feet, with about 18 inches of that width enriched, so that a sample from the crosscut of the enriched part assayed: Gold, trace; silver, 0.3 oz.; copper, 7.6 per cent. A sample of the remainder of the 6 feet assayed: Gold, trace; silver, trace; copper, 0.8 per cent.

A crosscut (No. 3) 21 feet long is driven on the right side of the adit at a point about 90 feet from the portal, where the narrow fissure crosses, but no ore is exposed. An upraise (No. 2) is made on the right side of the adit about 39 feet beyond the No. 3 crosscut. This upraise is 35 feet high, with about 18 inches of ore in the top, a sample of which assayed: Gold, trace; silver, trace; copper, 2 per cent. Some ore was taken and shipped from this upraise while work was progressing, according to information received from the mine foreman.

The south-westerly wall of the main adit is along a slip that appears to be the same fracture-plane as occurs at the portal of the adit. The main adit is driven for a distance of 21 feet beyond

upraise No. 2, where crosscuts are made from both sides; that to the right (No. 4) being 63 feet long, with a branch from the right side 32 feet long. No ore was exposed by this work. Crosscut No. 5, to the left of the adit, is made through a brecciated zone of mineralized rock 12 feet wide. An average sample along the first 6 feet of this crosscut assayed: Gold, trace; silver, trace; copper, 3.1 per cent. Two average samples from the next 18 feet showed no values. The mineralization in this crosscut is composed of magnetite chiefly, with some iron pyrite and grains of chalcopyrite disseminated through the magnetite.

Beyond the section sampled in the crosscut, or 30 feet from the main adit, the crosscut is made through a barren lime-silicate rock for 27 feet farther, with a well-defined boundary or contact line at the face of the section sampled. This appears to be the main line of contact between the metamorphosed igneous rock and limestone, with its strike north-west (mag.) and dip almost vertical.

The face of the main adit is about 160 feet beyond crosscuts Nos. 4 and 5. A change in the direction of the adit is made from N. 80° W. (mag.) to W. (mag.) about 10 feet south-easterly from upraise No. 2, and this change was made to conform with a similar change in the strike of the fracture-plane; but the direction was changed again to N. 60° W. (mag.) 56 feet from the first change; then to N. 80° W. (mag.) for about 80 feet; then to N. 60° W. (mag.) to the face, which is in limestone.

The dip of the fracture-plane which forms the south-west wall of the main adit changes from about 70 degrees to the southerly to about 80 degrees to the northerly and back again more than once in the length of the main adit. This fact, considered with the shearing and crushing movements and the irregularity of the structure of the ore-bodies that are so much in evidence, tends to increase the difficulties of doing development-work to the best advantage. The No. 2 upraise has been made where the dip is towards the north, but the No. 3 upraise, which is about 80 feet to the north-westerly from No. 2, is made where the dip is 74 degrees to the south.

Some ore occurred in the main adit where this upraise is made, and the management states that the raise passed through bunches of good-grade chalcopyrite to near the top, which is about 80 feet above the floor of the adit. It is proposed to continue this raise to the surface for ventilation and prospecting purposes. Beyond this upraise it appears as though the work has been done too far toward the south-west.

Between the No. 3 raise and the face of the adit, a distance of about 100 feet, there is no ore exposed and the country-rock is badly sheared and faulted. Some garnetite occurs near the face of the adit, but this is displaced by barren limestone at the face.

Unfortunately, practically no drifting has been done at places where ore is exposed, except from the face of the No. 1 crosscut, where drifts have been driven in both directions, each about 20 feet long, and ore mined from an excavation about 9 feet wide, 36 feet long, and 7 feet high. At the south-easterly end of the chamber a little ore is exposed in garnetite and epidote gangue, but this is not many feet from the outcrop near the portal of the adit, so that it is hardly worth while continuing work in that direction. At the north-westerly face of the chamber there is a body of garnetite with a little chalcopyrite disseminated through it, and it appears as though it would be advisable to continue to drive in that direction to prospect the possibilities.

From the foregoing description it will be seen that the occurrences of ore-bodies in the contact-metamorphic zone are erratic and irregular, and that the bodies of higher-grade solid ore are lenticular in shape, but that apparently some of the lenses can be traced from one to another. Such connections are generally difficult to trace, and consequently a very close study of the geologic structure is essential in order to carry on development-work to the best advantage.

The prevailing minerals are chalcopyrite, pyrite, magnetite, and a little pyrrhotite. The gangue in which ore occurs is almost invariably garnetite, epidote, and altered limestone, but sometimes it is brecciated diabase.

The prominent structural features of the ore-bodies is the occurrence of lenses of chalcopyrite of shipping grade in the contact-metamorphic zone, together with ore-bodies of greater extent of concentrating grade; consequently it should prove more satisfactory to carry on development-work in such a manner as to demonstrate the quantity of ore as a whole, rather than to gouge around in order to attempt to find the higher-grade lenses. The feature of irregularity in the occurrences of the lenses of chalcopyrite, of high enough grade for direct shipment, is particularly shown in the No. 3 upraise. This was started in a body of chalcopyrite of good grade, but within a few feet this gave place to low-grade concentrating-ore, and a few feet

higher another lens of shipping-ore occurred, which was passed through into low grade and so on to the present top of the raise. The most persistent ore-body apparently occurs between the No. 2 and No. 5 crosscuts, a distance of about 70 feet, but as the main adit has been driven parallel to the apparent wall of the ore-body instead of in the ore, the extent has not been proven, although drill-holes have been made into the wall on the south-westerly side of the adit, the drillings from which, it is stated by the manager, showed values in copper.

Development-work.—The development-work on the Leonard ore-body is as follows:—

	Feet.
Main drift-adit	308
No. 1 crosscut on north-east side of adit	34½
Westerly drift, No. 1 crosscut	15
Easterly drift, No. 1 crosscut	21
No. 2 crosscut on south-west side of adit	24
No. 3 crosscut on north-east side of adit	21
No. 4 crosscut on north-east side of adit	63
Branch of No. 4 crosscut north-east of adit	32
No. 5 crosscut on south-west side of adit	57
No. 6 crosscut on south-west side of adit	27
No. 7 crosscut on south-west side of adit	10
No. 8 crosscut on north-east side of adit	26
No. 1 upraise on south-west side of adit	10
No. 2 upraise on north-east side of adit	35
No. 3 upraise on north-east side of adit	80
Total	763½

A trail has been built around the steep bluffs that form the shore of the canal about half a mile long, and for nearly half the distance the trail is blasted from precipitous solid rock bluffs. This trail connects the camp buildings with the mine-workings.

Equipment.—The plant at the mine-workings on the Leonard showing consists of a well-equipped blacksmith-shop, 4-drill compressor plant, 35-horse-power boiler and ore-bunkers 49 feet long by 27 feet wide by 20 feet deep. The compressor plant, boiler-room, and bunkers are built on a solid rock foundation on the shore about 10 feet above high-tide mark.

Transportation.—The transportation problem is as nearly ideal as is possible. The portal of the main adit is about 60 feet above high tide and about 45 feet from the shore. The depth of water in this part of Alberni canal close to the shore is about 50 feet, so that no wharf is necessary, but merely a floating log to prevent a vessel from scratching against the rocks on the shore.

As no work has been done on either the Maynard or Hedley ore-bodies since 1916, and a description of what had been done was published in the Report for that year, on pages 321 and 322, it is not necessary to repeat it.

Conclusions.—Owing particularly to the extremely good transportation facilities and favourable location of the *Monitor* mine, it appears advisable to continue the development of the property and by systematic work demonstrate the *actual* tonnage of ore available for shipment direct or for treatment by concentration. Operations can be carried on at a minimum cost for mining and transportation, so that the mine has an advantage in these respects over a property less favourably situated.

The fact that a shipment of ore was made to the Tacoma smelter during the past summer, which was mined as development-work progressed, is encouraging, while the apparent extent of the contact-metamorphic zone, in which there are good opportunities for ore-bodies of considerable extent to occur, is an indication of the promising possibilities of the property if fully developed.

Happy John Group.

This group consists of the *Happy John*, *Happy John No. 2*, and *Happy John No. 3* mineral claims, and is located on the west side of Alberni canal, adjoining the *Monitor* mine. Handy creek flows between the two groups of mineral claims and forms the dividing line between the *Happy John No. 1* and the *Nawitka* claim of the *Monitor* group. The *Happy John No. 1* extends to the shore of Alberni canal and has a water-front about 1,500 feet long, with a good location for a wharf and ore-

bunkers. The group is owned by Samuel Ryder, of St. Albans, England, and the property is Crown-granted and known as Land Lots 606, 607, and 608. The mineral claims contain approximately 150 acres.

Geology.—The rock formation on the *Happy John* group is very similar to that on the *Monitor*. There are at least two parallel zones of contact-metamorphic rocks occurring on this group of mineral claims. There are indications that these zones are extensions of the contact-metamorphic zones which occur on the *Monitor* group. A well-defined contact between an igneous rock and crystalline limestone occurs on the *Happy John No. 2* claim. The line of strike of this contact, if extended towards the south-east, would intersect the *Nawitka* claim in the *Monitor* group near the Hedley ore-body, and if projected to the shore of Alberni canal would terminate near the portal of the main adit on the Leonard ore-body. The rocks on the *Happy John* group have been subjected to similar shearing and fracturing movements as those on the *Monitor*.

The steep banks of Handy creek have afforded good opportunities for prospecting, as that creek crosscuts the formation diagonally.

Characteristics of the Ore-deposits.—The most promising showing of copper ore on the *Happy John* group so far discovered is on the *Happy John No. 2* claim, about 2,500 feet from the mouth of Handy creek, at an elevation of about 1,000 feet above sea-level. A gossan or iron capping occurs which can be traced in an almost continuous line in a south-easterly direction for about 400 feet from an old shaft sunk in the mineralized outcrop. This shaft is said to be about 25 feet deep, but was full of water at the time of examination.

The shaft at the collar exposes an ore-body 5 feet wide, of the contact-metamorphic type, dipping vertically. A sample from the dump at the collar of the shaft assayed: Gold, trace; silver, 0.6 oz.; copper, 7.2 per cent. The mineralization of the ore-body is a combination of chalcopyrite, magnetite, and iron pyrite, occurring in a gangue made up principally of garnetite.

Prospecting on the bank of Handy creek has exposed several lenses of chalcopyrite associated with magnetite, iron pyrite, and some pyrrhotite, usually in a garnetite gangue.

Development-work.—The development-work consists of the shaft referred to above; an adit about 30 feet long, driven at a point about 400 feet south-easterly from the shaft and about 100 feet lower elevation; besides several open-cuts and trenches in the bank of Handy creek.

Dauntless Group.

This group of mineral claims contains the *Dauntless No. 1*, *Dauntless No. 2*, *Evelyn*, and *Cora* claims, and is located on the west side of Alberni canal about one mile and a half from the town of Port Alberni. The two first-named claims are located along the shore of the canal, with the two last named adjoining on the west. The property is owned by Mr. Lewis, of Port Alberni, and contains an area of approximately 200 acres.

Geology.—The rock formation on the *Dauntless* group of mineral claims is igneous. There has been considerable shearing movement, and well-defined fissures are noticeable close to the shore of the canal, with about 200 feet of country-rock lying between them. The strike of the fissures is westerly and the dips nearly vertical.

Characteristics of the Ore-deposits.—There are deposits of ore which belong to the shear-zone type in each of the fissures mentioned. The mineralization consists of chalcopyrite associated with iron pyrite occurring in a gangue made up of quartz and breccia, with the quartz usually predominating. The mineral is scattered through the gangue as lumps and grains.

Where work has been done on the deposits the fissures in each case are at least 7 feet wide, but the length has not been determined in either. A small shipment of sacked ore was made from this property in 1918, and the sample taken for assay was from the dump remaining after the shipment was made. It assayed: Gold, trace; silver, trace; copper, 2.2 per cent.

Development-work.—The development-work so far done has been of a prospecting character and consists of three open-cuts, two of which are on the northerly fissure. One of the cuts is about 100 feet above sea-level and about 200 feet from the shore. This cut is about 20 feet long, 5 feet wide, and 8 feet deep.

The second open-cut on the northerly fissure is just above high-water mark. It is 52 feet long, 7 feet wide, and about 12 feet high at the face, from which it is proposed to drive an adit as a drift along the ledge.

The third open-cut is on the southerly fissure near the shore. It is 12 feet long to the collar of an incline, which is 15 feet long and about 4 feet deep at the face, but being full of water could not be thoroughly examined.

Three Jays Group.

This group of mineral claims contains the *Three Jay No. 1, Three Jay No. 2, Three Jay No. 3,* and *Blue Jay* claims, and is located on the west side of Alberni canal near the mouth of the Nahmint river, about fourteen miles below the town of Port Alberni, and at an elevation of about 1,500 feet above sea-level. The group is owned by W. G. Tanner, of Seattle, and associates, under a lease from the Provincial Government according to the Act of 1916, which provided for leasing any Crown-granted mineral claims that had reverted to the Crown by reason of tax sale. The property contains approximately 143 acres.

Geology.—The rock formation on the *Three Jays* group belongs to the Vancouver series and consists of igneous rocks and crystalline limestone typical of the west coast of Vancouver island. In the report by C. H. Clapp on "Southern Vancouver Island," he describes the igneous rocks on the westerly side of Alberni canal opposite the *Three Jays* group as belonging to the Vancouver volcanics, and the rocks on the *Three Jays* are very similar. In an old report by Chester Lee, published in the Report of the Minister of Mines for 1901, he classifies the light-coloured country-rock occurring on the property as "sausserite gabbro, containing augite and plagioclase, much altered by siliceous infiltration in cavities formed by the decomposition of monoclinic feldspars."

Characteristics of the Ore-deposits.—When development-work was first started on the property it appeared as though the strike of the ore-shoots was northerly, but as the work progressed it was found that the strike was easterly, and that there are three parallel mineralized zones in which the prevailing copper mineral is chalcopyrite, with spaces of about 100 feet between them. The ore-shoots dip about 80 degrees to the south, with a drag or pitch to the westerly.

The development-work shows that there are seven ore-shoots which vary considerably in both length and thickness. These are of the contact-metamorphic type, but are not always found close to the actual contact of the limestone and igneous rocks.

The ore mined during the early operations from about 1899 until 1901 often carried as much as 14 per cent. copper, but as the work progressed the percentage in copper decreased until it became too low in grade to be of commercial value under the then existing market price of copper, transportation, and smelter charges. The mine was closed down and remained idle until recently, when the Tanner interests arranged to reopen it, and began clearing out the old workings, rebuilding the camp, and repairing the road from the shore to the mine-workings. The intention of the lessees is to prospect the property thoroughly to determine its value as a concentrating proposition.

Development-work.—The total measurement of development-work on the *Three Jays* group is about 5,000 feet, made up principally of crosscut adits, drifts, and winzes. Nearly all of this work was done previous to December, 1900.

Canadian.

This mineral claim was mentioned in both the 1916 and 1917 Annual Reports, and is referred to again chiefly because Wm. Hutton, part owner, has shown so much industry in continuing to do development-work single-handed while Geo. Dickson, his partner, is serving overseas. The mineral claim is close to the grade of the Canadian Northern Pacific Railway near Coleman creek, on the east side of Alberni canal, about fourteen miles from Port Alberni. The area covered by the property is about 50 acres. The claim is owned by George Dickson and Wm. Hutton, of Port Alberni.

Geology.—The prevailing rock on the *Canadian* claim is classified by Clapp as Saanich granodiorite. Shear-zones are quite numerous and of considerable extent, as well as the evidences of contact metamorphism, although the actual contact between the igneous rock and limestone is not exposed in the vicinity of the occurrence of the ore-deposits. The contact is found about half a mile southerly from the mine-workings, where there are large massive beds of limestone which have been quarried for building purposes. Well-defined fissuring occurs within the shear-zones in the igneous rock, and slickensided cleavage-planes are of frequent occurrence, but these do not appear to have had much, if any, influence on the ore-deposits. Sometimes the walls of the main ore-deposit are slickensided, but often not.

Characteristics of the Ore-deposits.—The chief deposit of ore found on the *Canadian* claim is a more or less solid body of chalcopyrite varying in grade from 7 to 10 per cent. in copper, with low values in gold and silver. This body fills a fissure in a shear-zone in the granodiorite; its structure is lenticular. Below the outcrop the ore was about 6 feet wide and 30 feet long to a depth of about 15 feet, or to the bottom of the open-cut.

Another lens of chalcopyrite outcrops about 30 or 40 feet higher up the mountain and about 50 feet north-easterly from the open-cut just mentioned. This lens has not been prospected to any extent to determine its possibilities; it also appears to fill a fissure in the shear-zone and may have some connection with the ore-deposit opened up by the deep open-cut, or it may be a parallel deposit, which is quite probable and a not uncommon occurrence in the shear-zones on Vancouver island.

Since Hutton suspended work at the deep open-cut he has been driving a crosscut adit under the railway-grade in the expectation of intersecting the ore-body at a depth of about 20 feet below the grade. When the property was examined on July 20th last, this expectation had not been realized so far as exposing a body of solid ore similar to that he had been working on in the open-cut, but near the face of the crosscut adit some mineral was showing disseminated in the country-rock, with no well-defined walls.

Development-work.—There has been driven a crosscut adit about 70 feet long; an open-cut about 30 feet long, 14 feet wide, and 15 feet deep at the deepest point; and in addition several trenches and shallow open-cuts have been made. A wagon-road was built to the shore, about one mile distant, by the owners, with Government assistance of one-half of the cost, to enable Hutton to haul the ore mined; but, unfortunately, before this could be done the road-bed was so badly washed out by a cloudburst as to prevent hauling, and about the same time the Ladysmith smelter, which had been running for a while, closed down. About 75 tons of chalcopyrite ore, assaying between 6 and 10 per cent. in copper, is awaiting shipment on the dump. The property appears to possess sufficient merit to warrant further work.

As no new work has been done on other claims in the Alberni Canal section, and as the claims are referred to by the writer in previous Reports, repetition here is unnecessary.

BARKLEY SOUND SECTION.

Uchucklesit Harbour Subsection.

Except for the performance of assessment-work on mineral claims that have not been Crown-granted and which are situated in the mountains adjacent to Uchucklesit harbour, there has been practically little activity in the mining industry in that section of the Alberni Mining Division during 1918. The only exception has been at the *Sunshine* mineral claim, owned by W. Westwood, of Vancouver, the work on which is described later in this report.

Some years ago several shipments were made to the Ladysmith smelter of good grade of copper ore from the *Cascade* and *Southern Cross* mineral claims, situated near to the shore in Uchucklesit harbour, but after the *Southern Cross* was sold to an English syndicate, and it was proven that the *Cascade* is located on the Crown-granted land owned by the Wallace Fisheries Company, Limited, all work was stopped on both properties and has never been resumed.

There are several mineral claims adjacent to Snug basin, which is a part of Uchucklesit harbour near the entrance to Henderson lake, which have been partly developed and have promising possibilities, but have been idle for the past two years.

The geologic conditions are favourable for the deposition of ore-bodies; the outcrops are made up of chalcopyrite, pyrrhotite, magnetite, and iron pyrite, occurring in a gangue composed principally of garnetite and epidote. The ore-bodies so far as known occur as lenses and are irregular and of limited extent, but prospecting has not been carried on to any considerable extent. Beyond mining the ore that showed in the outcroppings, there has been comparatively little attempt to prove the possibilities of this section of the west coast of Vancouver island.

Sunshine. This mineral claim is one of the earlier locations in the Alberni Mining Division, from which a shipment of ore was made about 1915 to the Tacoma smelter, but the property has been idle from then until 1918. The group is located on Cascade creek, which flows into Uchucklesit harbour at Kildonan cannery, and is owned by W. Westwood, of Vancouver, who has been doing considerable development-work on the property during 1918. The group contains approximately 50 acres.

Geology.—The geologic conditions in the vicinity of the *Sunshine* group are very similar to those occurring on the *Monitor* and *Happy John* properties. The igneous rock is similar to the Saanich granodiorite and contains considerably more hornblende than is usually found in the rocks of the Vancouver volcanic series. The limestone is very thoroughly metamorphosed and the lines of contact between it and the igneous rock are very well defined.

Copper Island Subsection.

Marble Cove Group.

This group of mineral claims contains the *Marble Cove Nos. 1, 2, 3, 4,* and *5,* and is located on the west side of Copper island, Barkley sound. The property extends from the shore into the mountains in a south-easterly direction. The property is owned by James M. Russell, of Oak Bay, Victoria; George A. Smith, of Victoria; Andrew Smith and Carl Ulstrup, of Alberni; and contains approximately 250 acres.

Geology.—The rock formation on Copper island on the Marble Cove group is typical of that which prevails along the west coast of Vancouver island. It is made up of igneous rocks and crystalline limestone, with well-defined contacts, where the contact-metamorphic zones are of considerable extent, and in which much of the limestone is replaced by copper and iron minerals, as well as being altered to garnetite, with which is associated epidote.

Characteristics of the Ore-deposits.—Occurrences of copper ore are found on the *Marble Cove No. 1* claim about 900 feet in a south-easterly direction from the shore of a small bay. These occurrences are true types of the contact-metamorphic replacement deposits. The most important of these deposits outcrops on a limestone knoll about 400 feet above sea-level, where the copper and iron minerals have replaced the limestone over an area of about 60 feet long and 30 feet wide, a short distance from the actual contact between the limestone and igneous rock. Prospecting-work by driving an adit near the foot of the knoll has demonstrated that at this point the ore-deposit is also underlaid by limestone, appearing to grade off gradually from a fairly solid body of chalcopyrite and iron pyrite to grains and particles of the mineral disseminated irregularly through a gangue made up chiefly of a lime-silicate rock underlaid by crystalline limestone. The adit is about 70 feet long and is driven nearly the entire distance in limestone.

On the *Marble Cove No. 5* claim, about 800 feet in a south-westerly direction from the work above described, there is an occurrence of pyrrhotite and impure iron ore which belongs to the shear-zone type of deposits, as it occurs apparently filling a fissure in a rather wide shear-zone in igneous rocks. The strike of the fissure is towards the south-east and almost at right angles to the apparent strike of the limestone at the first-mentioned ore-deposit. A crosscut adit has been started to prospect this deposit of mineral, but work was discontinued after driving 15 feet and before any mineral was exposed.

About 200 feet in a south-westerly direction from the last-mentioned crosscut adit, and about 40 feet higher elevation, there are other outcroppings of impure pyrrhotite, but no work has been done to determine whether there is sufficient chalcopyrite mixed with the pyrrhotite to warrant mining.

About 60 feet south-westerly from the pyrrhotite outcroppings the line of strike of the rock formation changes to the south-westerly, and the rocks change to limestone and lime-silicate rock, with which is associated lenses of chalcopyrite, with much garnetite as the gangue. The mineralization occurs at the contact between the igneous rock and limestone.

Another occurrence of copper minerals outcrops about 500 feet in a south-easterly direction from that just referred to. The outcroppings indicate low-grade copper ore of the chalcopyrite variety, associated with pyrrhotite, magnetite, hornblende, garnet, and epidote. About 150 feet in a south-easterly direction from the last mentioned there is another outcropping of mineral made up chiefly of pyrrhotite and hornblende, with a little chalcopyrite.

Judging from the general geologic conditions surrounding this property, it appears as though they were favourable for deposition of ore-bodies, and that a more thorough and systematic method of prospecting is fully warranted.

Development-work.—The development-work on the *Marble Cove* group consists of about 100 feet of tunnelling and a number of open-cuts. A good trail has been made, with the assistance of the Government, from the shore to the main mine-workings, a distance of about half a mile.

All work was suspended last summer, as J. MacD. Russell had expended the total amount he had agreed to do, and his associate owners were reluctant to consider incorporating the property in a joint-stock company.

Hawkins Island Subsection.

At the westerly entrance to Barkley sound, on the west coast of Vancouver island, there is a large group of small islands, locally known as "The Thousand Islands," of which Hawkins island is the farthest westerly. It contains about 43 acres, more or less, is about half a mile

long, and has the shape of a triangle, with the widest end at the easterly side and the narrow end facing the west. There are about 10 acres cleared and a portion of it is planted in garden and orchard to supply the hotel, which is a favourite summer resort for some of the tourists. The writer visited the island on July 19th, 1918, to examine some mineral outcroppings reported to occur on the easterly end.

Benson. This mineral claim occupies all of the area of Hawkins island. It is reached by launch from Port Alberni, a distance of about forty miles, or from Sechart whaling-station, about eight miles distant. Hawkins island is owned by Mrs. Benson, the widow of an old-time sealing captain and one of the early pioneers on the west coast of Vancouver island.

Geology.—Hawkins island presents a view from the sea of being a bold rocky bluff that reaches an altitude of a few hundred feet, with an inhospitable coast against which the waves from the open ocean break with great violence during a storm, but a closer inspection reveals a sandy beach on the easterly side of the island slightly sheltered and on which small boats can land. An examination of the rocks shows that the geologic conditions are very similar to those already described as prevailing in the Alberni Canal section and on Copper island. The igneous rock, which resembles granodiorite, is the prevailing rock on the island, but there are also lenses of limestone which contact with the igneous rock, resulting in forming contact-metamorphic zones, in which are found outcroppings of magnetite of apparently limited extent. A sample from one of these outcrops assayed 44.5 per cent. of iron. As this ore appeared to be somewhat manganiferous, the sample was assayed for manganese, but the result showed that it contained none.

Henderson Lake Subsection.

Julius Donner, an old-time prospector on the west coast of Vancouver island, was engaged during a part of last season prospecting near the foot of Henderson lake. He located the *Krissie* group of mineral claims for himself and Andrew G. Larson, of Kildonan, as the result of his prospecting-work. With the exception of this work and some assessment-work done by the owners of other mineral claims near the shores of the lake, there was no activity in this section.

There are quite extensive contact-metamorphic zones at several points along the shores of Henderson lake, but comparatively little development-work has been done on any within late years. This inactivity is partly owing to the difficulty of transportation from the lake to Uchucklesit harbour because of the rapids in the narrows at the foot of the lake. Some years back the Dominion Government had work done to make a channel through the rapids for small boats, and, if this work was continued, a channel through which scows and launches could be taken might be made at a reasonable cost.

Krissie Group. This group of mineral claims contains the *Krissie* and *Monk II.* and is located near the foot of Henderson lake, on the westerly side. The claims are located near an old claim from which a small shipment of copper ore was made to the Tacoma smelter in 1917. The claims were only staked during 1918; consequently but little work has been done, and thorough prospecting is necessary to determine whether the property possesses commercial value.

GREAT CENTRAL LAKE SECTION.

The *Big I.* and *Della* groups of mineral claims are the only locations in the Great Central Lake section which belong in the Alberni Mining Division. The claims in these two groups are near the summit of Big Interior mountain, but on the side which forms the watershed of Great Central and Buttle lakes. The groups were described in the Report for 1913, on pages 314-318; consequently, as there has been no development-work done since then, it is not necessary to repeat the description in the present report. The section is, however, mentioned here because of the fact that the geologic conditions bear a strong similarity to those found in portions of the Coast range of mountains on the Mainland, notably in the Britannia belt, and for that reason it is considered important that the attention of prospectors should be called to the conditions.

Only a small corner of the Big Interior range of mountains is included in the Alberni Mining Division, as the summit toward the north-west forms the dividing line between the Nanaimo and Clayoquot Divisions, under which headings the range is again referred to later in this report.

A casual examination of the geology leads to the opinion that this mountain range is made up of a mass of eruptive rocks, chiefly granodiorite, but after a closer inspection and a comparison with the conditions in the Coast range the occurrence of bands of stratified rocks is

noticeable, and the fact that at the contacts between these and the granodiorite intrusives there occurs more or less mineralization. The stratified rocks are schists, quartzites, argillites, and limestones. The mineralization is made up chiefly of chalcopyrite and iron pyrite, occurring in a siliceous gangue. Sometimes, as on the *Della* group, there occur fissures in the igneous rock filled with gold-bearing quartz veins, but this characteristic appears to be unusual, and to the writer's knowledge is only found as a rare occurrence.

CLAYOQUOT MINING DIVISION.

The Clayoquot Mining Division, for the purpose of this report, has been divided into the following sections: Tofino section, comprising Kennedy Lake and Deer Creek subsections; Central West Coast section, subdivided into Bedwell Sound, Ahousat, Sidney Inlet, and Nootka Sound subsections.

Despite the fact that the Clayoquot Mining Division was formerly much prospected, as it was quite a popular resort for prospectors about twenty years ago, it cannot be claimed that the Division has been much more than scratched over, and there are excellent opportunities for prospecting parties to explore the mountains at the heads of creeks which flow into the several inlets and arms of the sea. Transportation in the Clayoquot Mining Division is quite easy, as there are so many miles of inside protected waters where small boats or canoes can be used, as well as Kennedy lake, one of the largest lakes on Vancouver island.

The Clayoquot Mining Division probably still contains a greater area of unexplored territory than any other of the Mining Divisions on Vancouver island, except that portion of the Nanaimo Mining Division in which is situated Strathcona Park. The highest range of mountains on the island, which forms the watershed between the streams that flow to the easterly coast and those that flow towards the westerly, also forms the dividing line between the Clayoquot and Nanaimo Mining Divisions and is the backbone of the island.

The geologic conditions in this range of mountains are somewhat similar to those in the Coast range so far as known at present, being made up of masses of eruptive rock, mainly granodiorite, with some broad bands of stratified rocks which have been intruded by the eruptives. The contacts of these bands of stratified rocks with the granodiorite are more or less mineralized, with copper minerals, usually chalcopyrite, predominating.

Tofino Section.

Kennedy Lake Subsection.

The Kennedy Lake subsection of the Clayoquot Mining Division contains some of the earliest discoveries of lode minerals, especially gold, that were made on Vancouver island. As far back as 1899 a concentrating plant was installed on the *Rose Marie* mine, now known as the *Rose* group, by the late Barclay Bonthrone for an English syndicate. This property is located on Elk river, near the head of Kennedy lake, and was described by the writer in the Report for 1916, since which time it has been idle.

Several other mineral claims have been located near the *Rose*, on which fissure-veins filled with gold-bearing quartz occur. A small mill was operated some years back on the *Leora* claim, which was also described in the Report mentioned.

There is no doubt but that the vicinity of Elk river would be found to be a good section to prospect, provided transportation facilities for hauling ore and supplies were opened up between that river and Taylor river, which flows into Sproat lake, in the Alberni Mining Division. At the present time the prospects on Elk river, of which there are several, are handicapped to a greater extent than many other sections on the west coast of Vancouver island, because of lack of good transportation facilities.

The present route to reach Elk river is by steamer from Victoria to Clayoquot sound; launch from there to the mouth of Kennedy river; canoe or small boat up the rapids to Kennedy lake; boat up the lake to the mouth of Elk river; canoe up the river about two miles; then trail to the prospects. At some seasons a canoe can be taken about four miles farther up the river, but during high water or very low water it is not advisable to attempt to take a canoe farther than the first two miles.

During the summer of 1918 the writer attempted to make a thorough examination of all the prospects on Elk river, but on account of the extremely low water was unable to take a canoe up, and found the old trail impassable, so was compelled to abandon the trip.

Wanderer Group.

This group contains two mineral claims—the *Wanderer* and *L. Grant*—and is located at the summit of a deep gulch about a quarter of a mile from the shore of Kennedy lake, about two miles from the mouth of Elk river and about 300 feet above the lake-level. The group is owned by L. Grant, of Tofino, and the claims are staked as full claims and contain about 100 acres.

Geology.—The rocks on the *Wanderer* group are igneous and apparently belong to an extension of the belt of Vancouver volcanics that occurs in the vicinity of Henderson lake, in the Alberni Mining Division. These rocks are much sheared, fissured, and altered. In places the shearing action has been so severe as to give the rocks schistose structure. The fissuring has resulted in the development of narrow quartz veins, which at and near the surface show quite good prospects in free gold by panning.

Characteristics of Ore-deposits.—The ore-deposits on the *Wanderer* group belong to the shear-zone type. The quartz veins which carry values in gold are narrow, but appear to be persistent, having the lines of strike S. 40° W. (mag.) and dip 72 degrees to the north-west (mag.). Some of the oxidized outcroppings furnish fine specimens of quartz, with particles of free gold in the quartz gangue. If further development determines that the veins increase in width and carry fair values throughout, this property would be a good milling proposition.

The topography of the ground is such that development-work can be carried on by a series of adits which would gain backs rapidly as they were driven into the mountain, which rises to an altitude of several hundred feet within a short distance from the outcroppings.

Development-work.—The development-work done up to September 7th, 1918, represented one assessment-work and consisted of two open-cuts and short adits. The upper open-cut is 12 feet long as an approach to an adit 6 feet long under cover. A sample from 6 inches of quartz assayed: Gold, 0.32 oz.; silver, 0.4 oz. The lower open-cut is about 25 feet below the upper; it is about 15 feet long as an approach to an adit 4 feet long. Two samples were taken at this work; one from the floor under cover assayed: Gold, 0.64 oz.; silver, 0.8 oz. The other sample, taken from near the face, assayed: Gold, trace; silver, trace. A selected specimen assayed: Gold, 1.86 oz.; silver, 0.8 oz.; copper, 15 per cent.

The location-line of the claim was followed in a north-easterly direction for some distance to the No. 2 post of the claim, where it appeared that the vein was persistent to that point, but this had not been determined by any work. This group of claims was only staked a short time prior to the examination.

O.K. Group.

This group of mineral claims consists of four claims known as the *O.K. No. 1*, *O.K. No. 2*, *O.K. No. 3*, and *O.K. No. 4*, and is located at the summit of the mountain at an elevation of about 4,000 feet, between the Clayoquot arm of Kennedy lake and the main lake. There is practically no trail to the group, except up the bed of Sandy creek, which is full of large boulders. Sandy creek flows into Kennedy lake about six miles from the head, and the distance to the mine-workings on the *O.K. No. 3* claim is about four miles. There could be a fair trail built from the head of Clayoquot arm which would be shorter than the present route, but somewhat steeper. The group is owned by T. G. Norger, of Victoria, who staked the claims about 1900, built a cabin on the summit, and worked on the property almost continuously until he obtained a Crown grant, since which time but little further development-work has been done. The group contains about 195 acres. The claims are staked in a northerly direction from Norger creek, a branch of Sandy creek, in a line one claim wide, with the *O.K. No. 1* as the most southerly and the *O.K. No. 4* the most northerly.

Geology.—The rocks on the *O.K.* group belong to the Vancouver series and consist of white and blue limestones and dioritic rocks, with the limestone occurring in extensive masses on the southerly part of the property and dioritic rocks on the northerly part. The bedding-planes of the limestone strike east (mag.) and dip 40 degrees to the north. The dioritic rock is sheared, fractured, and altered, especially so near the line of contact with the limestone.

Characteristics of the Ore-deposits.—The occurrences of copper ore belong to the contact-metamorphic type, although they do not occur at the immediate contact of the igneous and sedimentary rocks, but are found enclosed by walls of the dioritic rock. The mineralization is chiefly chalcopyrite, with which is associated iron pyrite and some pyrrhotite and magnetite.

The outcroppings are characterized by the chalcopyrite occurring in masses of rather unusual purity and considerable size. These outcroppings are quite persistent for about 200 feet along the surface, where the mineral is about 3 feet wide, as shown by trenching. The strike is

S. 20° E. (mag.) and dip 50 degrees to the easterly. Samples from the outcrops can be taken which carry quite high-grade ore in copper values, but a sample taken from the underground workings assayed only: Gold, trace; silver, 0.8 oz.; copper, 4.7 per cent.

The surface outcrops are on the *O.K. No. 3* claim and gave promise that the property would develop into a mine that would produce a grade of copper ore sufficient to warrant shipping direct to a smelter, but in the underground workings, which are almost directly under the trench along the outcrops, it does not appear as though the ore-deposit had maintained continuity or value to any appreciable depth. The ore occurs on the northerly side of the summit between the main Kennedy lake and the Clayoquot arm of the lake, where the mountain-side is very precipitous, and float as well as some outcrops are found at other points on the mountain-side, but no work has been done to determine their extent.

Development-work.—The development-work on the *O.K.* group is confined to that on the *O.K. No. 3* claim, and consists of an adit about 105 feet long, in addition to about 200 feet of rather deep trenching. The adit was started as a crosscut and driven 60 feet. At a point 21 feet from the portal some ore is exposed and the course of the adit changed to the right or at right angles for 15 feet, where the course is again changed to the left at right angles for 30 feet. Some ore is crosscut in the last change in the course of the adit, and it appears as though this occurrence of ore is possibly an extension of the ore exposed near the portal in the main adit.

Northern Crown. This mineral claim is owned by J. E. Martin, superintendent of Kennedy Lake Hatchery, whose post-office address is Tofino, B.C. The claim is located about 300 feet above sea-level near the head of Clayoquot arm of Kennedy lake. The property is easy of access, being only about a mile and a half from the Kennedy Lake Hatchery by water and about half a mile by a good trail from the shore. The claim is staked for a full-sized mineral lode claim, 1,500 feet square.

Geology.—The geologic formations on this mineral claim belong to the contact-metamorphic type, the rocks being igneous and altered sedimentaries. The results of metamorphism are well illustrated and the line of contact clearly defined between the dioritic igneous rock and limestone. The latter occurs as forming high precipitous cliffs, with the line of strike of the bedding-planes N. 70° W. (mag.) and dip 65 degrees to the north-east (mag.). There are some igneous intrusive dykes which cut the limestone.

The mountain range back of the *Northern Crown* claim forms the watershed between the Clayoquot arm and the upper part of Tofino inlet. The peaks rise to altitudes exceeding 3,000 feet within a short distance from the shore. The section presents a promising field for prospecting.

Characteristics of the Ore-deposits.—The occurrences of ore on the *Northern Crown* claim are replacement deposits in limestone and represent illustrations of Clapp's contact deposits in a zone of contact metamorphism some distance from the actual line of contact. The mineralization is made up of pyrrhotite, chalcopyrite, and iron pyrite, with the pyrrhotite in some portions of the deposit the most abundant. The gangue material is chiefly limestone and the usual contact minerals, garnetite and epidote.

Samples taken from across about 3 feet where the outcrop has been stripped on the southerly side of a high precipitous limestone cliff assayed: Gold, trace; silver, 0.8 oz.; copper, 8.4 per cent. Gold, trace; silver, trace; copper, 1.5 per cent. Another sample from a sorted dump at the portal of a short adit assayed: Gold, trace; silver, 0.8 oz.; copper, 9.1 per cent.

Development-work.—The development-work on the *Northern Crown* mineral claim consists of an open-cut along the strike of an outcrop 38 feet long and an adit about 50 feet below the open-cut. The adit is driven about 62 feet long, with an open-cut approach about 12 feet long. The adit was driven with the purpose of intersecting the ore-deposit exposed in the upper open-cut, but it appeared to the writer that the adit had been driven too far to the left from the portal to accomplish the purpose, and that the course from the portal should have been nearly at right angles to that taken. Near the face of the adit the course has been changed to the right, and there are indications of ore near the face.

Deer Creek Subsection.

Deer creek empties into Tofino inlet, Clayoquot sound, at the head of the inlet. Several years ago this was one of the most popular fields for the prospector on the west coast of Vancouver island, when several mineral claims were staked and partly developed. The South

African war caused the first interruption to activity in the section, because some Englishmen who were operating on the *Jumbo* mineral claim left for the war and have never returned. The property reverted to the original owners and remained idle until 1916, when it was bonded by Sam. Silverman, who had considerable work done on it and on the adjoining claim, the *Crow*, but failed to complete the purchase, and the two claims again reverted to the original owners, remaining idle since. These properties were examined by the writer in 1916, and his report was published in the Minister of Mines' Report for that year.

There was some revival of prospecting during 1916 when a prospector named Walton staked the *White* claim on the northerly side of Deer creek, sold an interest in it, and enlisted for service overseas.

White. This mineral claim is on the northerly side of Deer creek about a mile and a half above the mouth of the creek by trail, and about 2,500 feet elevation. The claim is reached by launch from Tofino or Clayoquot to the mouth of Deer creek, and from there by an excellent trail up the northerly side of the creek. The claim is owned by Wm. N. Walton and Duncan McMillan, of Bamfield Creek, and is a full-sized claim, 1,500 feet square.

Geology.—The geologic conditions on this part of the Deer Creek section appear to be quite favourable for the deposition of ore, as there are some wide fissures in shear-zones in igneous rocks of a dioritic character. The fissures are filled chiefly with such non-metallic gangue minerals as garnet and epidote derived from contact metamorphism, scattered through which are pieces of chalcopyrite.

The most prominent of the fissures is about 12 feet wide between dioritic walls; its strike is westerly (mag.) and dip nearly vertical. It is exposed cutting into a steep mountain-side which rises vertically for about 75 feet from a point about 150 feet above a narrow terrace or bench, on which a cabin is built for the mining camp, at an elevation of about 2,500 feet. Beyond the summit the mountain continues to rise to much higher elevation, and forms the watershed between Deer and Tranquil creeks.

In the vicinity of the cabin there is a wide zone of contact-metamorphic rocks in which are several lenses of chalcopyrite associated with some pyrrhotite, iron pyrite, and magnetite, in a gangue composed of garnetite, epidote, limestone, and breccia.

Characteristics of the Ore-deposits.—The most extensive outcrops of ore occur in the vicinity of the cabin, and it is a question whether all of the outcroppings are in-place or have resulted from a slide from the steep mountain above, in which occurs the fissuring already referred to under the heading "Geology."

The ore-deposits belong to the contact-metamorphic type, but occur in the zone of contact metamorphism at some distance from the actual contact. Samples taken from two of the so-called lenses in the vicinity of the cabin assayed:—No. 1: Gold, trace; silver, 1.6 oz.; copper, 11.5 per cent. No. 2: Gold, trace; silver, 1.6 oz.; copper, 12.5 per cent. The property certainly merits thorough prospecting, as it has good indications and promising possibilities.

Development-work.—The development-work consists of several open-cuts within an area of about 120 feet long and 10 to 15 feet wide, a short adit and surface stripping representing two years' assessment-work. In addition, the owners, aided by the Department of Mines, have constructed an excellent trail about a mile and a half long and built a cabin.

CENTRAL WEST COAST SECTION.

Bedwell Sound Subsection.

The Bedwell sound is an arm of Clayoquot sound and penetrates into the west coast of Vancouver island for a distance of about twenty-five miles. There has never been any prospecting done in the mountains adjacent to the shores of the sound itself, but about twenty years ago there was a good deal of prospecting-work done in the mountains near the head of the sound and along Bear river, which has its source in the Big Interior range and flows westerly into Bedwell sound at its head.

There were quite a number of mineral claims staked in this section of the Clayoquot Mining Division previous to 1899, several of which were sold about that time and furnished the prospectors with good stakes. The section was quite active until about 1900, when for various reasons, chiefly lack of capital and in some instances disappointment in the actual results from

partial development, all activity ceased. The owners of mineral claims that had not been Crown-granted continued to hold on by doing assessment-work or restaking, while the owners of Crown-granted claims allowed them to remain idle.

About 1913 a revival of the old days of activity was brought about through the purchase of the *Ptarmigan* group of mineral claims at the head of Bear river by the representatives of the Earl of Denbigh, who proposed continuing the development-work commenced by the original stakers, and who purchased the old aerial tramway that had been in use at the *Tyee* mine on Mount Sicker from the Tyee Copper Company. The Ptarmigan Copper Mines, Limited, was organized, the trail up the Bear River valley was repaired, a new bridge built across that river at the canyon, and a camp erected in the mountains near the mine-workings. The declaration of war in 1914 resulted in the enlistment of practically every man in the employ of the company, the abandonment of operations, and the return of idleness of the section.

During 1918 the writer visited the Bedwell Sound section and examined the *Empress* mineral claim. It was his purpose to also examine the *Ptarmigan* group, but the snow was too low on April 24th, the date of his visit, to permit of reaching the elevation of that group, which is about 5,000 feet above sea-level.

Empress.

This mineral claim, owned by J. W. McIntosh, of New Westminster, is located on Bear river about four miles above its mouth. The mouth of Bear river is reached by gasolene-launch, rowboat, or canoe, starting from either the Clayoquot or Tofino settlements near the entrance to Clayoquot sound and about thirty miles distant from the *Empress* mineral claim. As there is no post-office or store at the mouth of Bear river or on Bedwell sound, there is no port of call for the West Coast steamers nearer than the settlements mentioned. The Canadian Pacific Railway Company's steamer calls at both of these points three times each month, usually on the 3rd, 12th, and 22nd.

The occurrences of ore on the *Empress* mineral claim occur on the east side of Bear river and about one mile above the bridge, which is located near the 3-Mile post on the wagon-road which has been built from the mouth of the river up the valley for about five or six miles. This wagon-road was built in 1913 by the Ptarmigan Mining Company, which was operating the Ptarmigan group of mineral claims, situated at the summit of the range of mountains that separates the Bear River valley from the Great Central lake, locally known as the Big Interior range of mountains.

Geology.—The country-rock in the vicinity of the ore-body on the *Empress* claim is granodiorite, sheared, fractured, and altered. Its general strike is N 15° W. (mag.) and dip 75 degrees to the north-east. There is a system of local cross-fracturing, the joint-planes of which strike north-east and dip 50 degrees north-west. There is also another system of fracturing or fissuring in the sheared zone, the joint-planes of which strike S. 60° E. and dip vertical. The country-rock occurs as steep bluffs or cliffs along the side of the wagon-road, and it was during construction that the sheared zone with the occurrences of copper ore were exposed. There has not been sufficient work done to determine the extent of the mineralized zone, but apparently it exceeds 25 feet in width and is of undetermined length.

Characteristics of Ore-body.—Copper ore in the form of chalcopyrite is found occurring on the cleavage-planes of the sheared country-rock. It is in narrow stringers and does not appear to be disseminated through the country-rock which forms the gangue in which the ore occurs. If the ore can be mined separately from the country-rock it would give good values in copper, but unless close sorting is done it is questionable whether satisfactory operations could be carried on, although it is possible that if systematic prospecting was done the shear-zone which carries the mineral might be found to be of sufficient extent to warrant the installation of a concentrating-mill.

An open-cut has been made in the roadway since the road was constructed which has exposed a width of the shear-zone about 25 feet, striking nearly at right angles to the course of the wagon-road, and several small piles of ore are piled up on the roadway. A general grab sample from some of these piles assayed: Gold, trace; silver, trace; copper, 5.1 per cent.

The writer did not observe any wide fissures filled with ore, nor could he find where any development-work had been attempted, except where a few shots had been put in on the road-bed. No well-defined lead or lode bearing mineral was seen, except a portion of the shear-zone which has been described.

Conclusions.—The ore occurrences on the *Empress* mineral claim are sufficiently promising to warrant further prospecting to ascertain the extent of the mineralized zone. It would appear, so far as one can judge from an examination of such work as has been done, that there is a possibility of developing an ore-body of the shear-zone type that might be operated on a commercial scale.

The present transportation facilities would not permit of carrying on mining operations unless the extent of the ore-deposits is very considerable or the ore quite high in grade, because there is at present a wagon-haul of four miles to the mouth of Bear river, where an approach about a mile long is necessary to reach a depth of water sufficient to accommodate any vessel larger than a small launch.

Ahousat Subsection.

The Ahousat section of the Clayoquot Mining Division contains several prospects in the vicinity of Cat Face mountain, also on Flores island and Herbert arm of Clayoquot sound, but except on Flores island there has been no activity in this section for several years past.

Ormond Group.

This group of mineral claims contains nine claims and is owned by James Beck, of Victoria. The property was quite fully described in the Annual Report for 1916, pages 334-336; therefore it is not necessary to repeat that description in this report. Since then the owner has done considerable additional development-work, which has improved the possibilities of the property.

It is stated that a bond has been taken on the group of claims by the Ladysmith Smelting Corporation, of Ladysmith, and that engineers will examine the property early in the season of 1919, and if satisfactory will commence active operations by extending the development-work to block out ore.

Sidney Inlet Subsection.

The Sidney Inlet subsection of the Clayoquot Mining Division has the distinction of containing the site on which is built the only concentrating-mill by the flotation method on Vancouver island, but this has been idle for the greater portion of 1918. This inactivity is owing to a reorganization of the Tidewater Copper Company, Limited, for which the mill was erected, and the desire to inaugurate the policy of the new management to thoroughly prospect and develop the *Indian Chief* group of mineral claims previous to attempting to stope and mill ore. It is also proposed to develop a water-power on Indian creek, which flows into Sidney inlet about half a mile north of the mill building, and thus do away with the cost of coal fuel.

Indian Chief Group.

This group, containing eight claims, was fully described in the Annual Report for 1917, pages 248-254, but is mentioned in this report because of the additional development-work that has been done in the mine during the past season. The property is owned by the Tidewater Copper Company, Limited, of Victoria, which was reorganized during 1918 and is now registered in British Columbia, with H. B. Price as manager.

Development-work.—The new development-work carried on during the past season has been confined to driving the No. 2 adit toward the workings on the north side of the mountain in which the ore-deposits occur, and driving a new crosscut adit on the *Scotlet* mineral claim. It is reported that this work has been quite satisfactory and has developed a considerable tonnage of copper ore of a commercial grade.

The preliminary work toward the development of the water-power on Indian creek has been done, and if the development-work in the mine continues satisfactory it is proposed to enlarge the concentrating-mill during the coming season.

QUATSINO MINING DIVISION.

The Quatsino Mining Division was examined by Victor Dolmage, of the Canadian Geological Survey, during 1918, who is preparing a geological map in detail, and whose report will be published in due course.

For convenience and to assist in locating the various mining properties in the Quatsino Mining Division, it has been subdivided in this report into the following sections, as follows: South-east Arm and West Arm.

Reference to a map of the Quatsino Mining Division shows that the above-named sections cover only a comparatively small portion of the Mining Division, which is accounted for because

of the fact that prospecting for metalliferous minerals has been confined almost entirely to the sections mentioned, and that the rocks in a considerable area of the Mining Division are sandstone, shales, and conglomerates, with coal, which has, however, so far not been found in commercial quantity. The coal-measures occur at Coal harbour near the junction of Rupert and West arms, also at Winter harbour near the entrance to the main Quatsino sound.

The coast-line northerly from Nootka island to Cape Scott, the most northerly point on Vancouver island, is extremely rough and inhospitable, with but comparatively few sheltered harbours, so that small launches or sailboats are not well adapted for use by prospectors; and, as there are no trails or roads in that portion of Vancouver island, prospecting on this part of the west coast has been neglected, except in the sections referred to.

South-east Arm Section.

Elk Lake Subsection.

The Elk Lake subsection embraces that portion of Vancouver island lying easterly and south-easterly of the South-east arm of Quatsino sound, which might be termed the Lakes section, as there are four lakes, each of considerable size, which form a chain with the waters flowing from one to another, and eventually into the Quatsino narrows at the entrance of Rupert arm of Quatsino sound. These lakes are called Victoria, Elk, Kathleen, and Alice. Victoria lake forms the south-easterly arm of the chain and flows into a mountain stream called Amazon creek, which empties into Alice lake. Elk lake forms the south-westerly arm of the chain and flows into a creek which empties into the head of Kathleen lake. Kathleen lake flows into a fair-sized stream called the Benson river, which empties into Alice lake. Alice lake flows into an unnamed river about seven miles long which empties into Quatsino sound at the Narrows. Although the lakes form a chain, there is no opportunity to navigate even a canoe through the streams which form the connecting-links, but there is a good pack-trail on the portages and the Coast Copper Company maintains good gasolene-launches on Alice and Kathleen lakes for carrying the men and supplies. There is a good pack-trail from June Landing on the South-east arm of Quatsino sound to the boat-landing on Alice lake, so that the trip to the mining camp of the Coast Copper Company is a comparatively easy one.

Old Sport Group. This group of mineral claims is the only property that has been actively operated during 1918 in the Elk Lake subsection. This group of mineral claims was quite fully described in the Annual Reports for 1916 and 1917, so that a repetition is unnecessary. During 1918 the development-work underground has been extended under the superintendence of Wm. Clancy, who has been manager of the property continuously since it was acquired by the Bacon Syndicate, of Spokane, which transferred it to the Coast Copper Company, a subsidiary of the Consolidated Mining and Smelting Company, of Trail, B.C.

South-east Arm Subsection.

Quatsino King Group. This group of mineral claims on the Teta river, which flows into the South-east arm of Quatsino sound on the westerly side, was prospected by diamond-drilling by the Granby Consolidated Mining, Smelting, and Power Company in 1917. The bond held by that company was cancelled in 1918 and the group has reverted to the original owners, the Teta River Mining Company, of Quatsino.

Yreka Group. This group was quite fully described in the Report for 1916, pages 337-339. Since that year the property has remained idle, but during the winter of 1918-19 it has been bonded by the Tidewater Copper Company, of Victoria, and Mr. Price, the manager, proposes making a thorough examination as early during the coming season as the conditions with regard to the snow will permit, with the view of operating the mine in connection with the *Indian Chief* on Sidney inlet.

West Arm Section.

In the past the West Arm section of the Quatsino Mining Division has appeared to have been almost neglected by prospectors so far as metalliferous minerals, except iron ore, are concerned, and has only been noticeable on account of the old workings for coal and bog-iron ore, but about 1916 some prospectors located mineral claims near the head of the arm, on which they found copper ore, chiefly bornite.

During the late fall of 1918 development-work has been done on two groups of mineral claims known as the *Bowerman* and *Millington* by D. Spooner and associates, of Holberg. These properties have not yet been examined by the writer, but it is his intention to do so early in 1919.

NANAIMO MINING DIVISION.

For convenience in locating the various mining properties in the Nanaimo Mining Division, it has been subdivided in this report into the following named sections: Strathcona, Salmon River, Quadra Island, Phillips Arm, Texada Island, Redonda Island, Cumberland, and Nanaimo.

The Nanaimo Mining Division is by far the largest of the Divisions included in the Western Mineral Survey District of British Columbia, and includes not only the eastern part of Vancouver island north of the town of Ladysmith, but nearly all of the islands lying between Vancouver island and the Mainland, as well as that part of the Mainland north-westerly from Powell lake to the southerly side of Seymour inlet, Queen Charlotte sound, and west of the Coast range of mountains.

There is practically very little known of the easterly part of the district on the Mainland, and except a small section at the head of the Klinaklina river, where a deposit of hæmatite iron ore occurs, there appears to have been no prospecting done in the interior; at least, no occurrences of metalliferous minerals have recently been reported.

Transportation facilities by water are excellent up all of the inlets, but beyond the heads there are no transportation facilities. In fact, the prospectors who staked the iron-ore mineral claims on the West fork of the Klinaklina river gained access to that section from the Chilcotin country to the east of the dividing line between the Western Mineral Survey District and the Central District.

STRATHCONA SECTION.

Buttle Lake Subsection.

The Buttle Lake subsection includes that part of Vancouver island reserved for Strathcona Park, which from about 1910 until 1918 was closed against prospectors. In the latter year this section was thrown open and during that year was prospected to some extent on Myra creek near the southerly end of the lake, where an occurrence of copper ore had been discovered some years ago.

Black Bear Group.

This group of mineral claims contains the *Black Bear*, *Cariboo*, and *Beaver* claims, owned by J. D. Breeze, James Cross, A. F. Breeze, and J. L. Kerr, of Vancouver. The claims have not yet been examined by the writer, but are mentioned in this report as an encouragement to prospectors to explore the mountains in the vicinity, as it is claimed that the *Black Bear* group is a property of very promising possibilities.

Nanaimo River Subsection.

The Buttle Mountain district of the Nanaimo Mining Division is also locally known as the South Fork of the Nanaimo River section, because it is drained by that river, and the mineral claims that have been located in the section are mostly in the vicinity of or at no considerable distance from the headwaters and tributaries of the river.

The Buttle Mountain district is reached from Nanaimo by way of the South Fork wagon-road to the city dam across the South fork of the Nanaimo river, a distance of about sixteen miles. From there a pack-trail is travelled in a westerly direction about four miles to the ford across Boulder creek; after crossing Boulder creek the trail follows up the Jump river for a few miles, then crosses a divide between the Jump and Green rivers. Green river heads in Buttle mountain and flows into the second Nanaimo lake.

The mineralized zone of the Buttle Mountain district appears to lie along the divide between the heads of the Jump and Green rivers. Some years ago there was considerable prospecting done in that section and several mineral claims were located, but during recent years there has been but little attention paid to mining in this vicinity, where operations are handicapped by lack of transportation facilities and consequent excessive costs.

The *Patterson* and *Jubilee* groups of mineral claims are amongst the oldest locations and have been the most extensively developed, but the workings at both of these properties have been idle for so long that no satisfactory examination can be made until the old workings are cleaned out and unwatered.

Allies Group.

This group of mineral claims contains four claims, known as the *Britain*, *France*, *Japan*, and *Serbia*, owned by Archie Cowie and associates, of Nanaimo. The group of claims is located on the northerly slope of Buttle mountain, with the *Japan* claim covering a part of the summit of the mountain, and the *Britain* the most northerly of the locations. The *France* claim adjoins the *Britain* on the southerly side and the *Serbia* claim adjoins the *France*. The claims are grouped as the *Allies* group, and practically all of the work has been done on the *France* and *Serbia* claims. The mining camp is near the head of Green river at the foot of Buttle mountain, and is reached by a newly constructed pack-trail about a mile and a half long which branches off from the Jubilee trail at the crossing of Jubilee creek.

Geology.—The prevailing country-rock on the *Allies* group is granitic, some of it having a gneissic structure. The granitic rocks are considerably fissured, with the fissures being filled with quartz. There appears to be at least two, if not three, series of fissures, which occur almost paralleling each other. The dimensions of the fissures have not been determined. The granitic rocks are very badly altered and metamorphosed.

Characteristics of the Ore-deposits.—The ore-deposits on the *Allies* group occur in quartz veins which are enclosed by granitic walls and vary in width from a few inches up to 5 feet at one place. The mineralization in the quartz is chiefly molybdenite, occurring in flakes and sometimes lumps of from about the size of coffee-beans to as large as a man's fist. Associated with the molybdenite there is generally a little chalcopyrite, but so far as assays of samples show there are no values in the precious metals.

The following is a list of assays of samples taken from various points from several veins, the relationship between which, if any exists, has not been determined by work:—

Sample.	Molybdenite.	Gold.	Silver.	Copper.
	Per Cent.	Oz. per Ton.	Oz. per Ton.	Per Cent.
Grab from dump	...	Trace.	Trace.	0.3
Selected	1.2	"	"	0.15
From outcrop	0.3	"	"	1.0
Vein 12 inches wide	0.96	"	"	Trace.
Vein 18 inches wide	0.96	"	"	*Nil.*
Specimen selected	23.1	....	....	....

All of the above samples were taken from the *Serbia* claim.

Development-work.—The development-work consists of an old incline shaft (full of water) on the *Serbia* claim; an adit on the *France* claim 30 feet long, close timbered; and several prospect-holes, most of which are on the *Serbia* claim.

Conclusions.—At present the property is badly handicapped by lack of good transportation facilities. Had further development-work been done early in the war, and transportation provided to haul sorted ore to Cowichan lake, which is the logical route for a road, it appears as though a production of molybdenite could have been assured. The possibilities of the deposits are quite promising, while the distance to Cowichan lake appears to be only about eight miles, where water transportation to the branch of the Esquimalt & Nanaimo Railway can be utilized.

If there is any substantial demand for molybdenite in future, this property is sufficiently promising to warrant systematic development as a concentrating proposition and with a view of treating the crude ore in a plant on the claims, where apparently a good supply of water for concentrating purposes can be obtained from Green river.

Float carrying good copper and silver values is found on Buttle mountain near the summit, but no thorough prospecting-work has been done to locate the source of this float.

Quinsam Lake Subsection.

The Quinsam Lake subsection contains that portion of the Division lying southerly and easterly of the Upper Campbell lake and drained by the Quinsam and Campbell rivers. At the present time the only occurrences of metalliferous minerals reported are deposits of magnetite. These occur south of Upper Quinsam lake, also on Iron river, a tributary of the Quinsam river.

The Upper Quinsam lake deposits are reached by a trail which branches off from the Campbell River-Buttle Lake wagon-road at Gooseneck lake, about twelve miles from the Campbell

River Post-office. The Iron River deposits are reached by a trail which branches off from the same wagon-road at the mouth of Iron river, about three miles easterly from Gooseneck lake.

Quinsam Lake Iron-ore Deposits.—These deposits of magnetite were fully described in Bulletin No. 3, 1917, Bureau of Mines Report, on the "Iron-ore Deposits of Vancouver and Texada Islands"; consequently it is unnecessary to repeat the description here. The deposits are mentioned here because they occur on a parcel of land covering 25,000 acres on the Esquimalt & Nanaimo land grant, which is under contract to the British America Timber Company, Limited, of Seattle, Wash.; also because, owing to the recent agitation regarding the establishment of an iron and steel industry, the situation of these deposits is an important consideration.

There are also immense deposits of limestone in the immediate vicinity of the iron ore, while the unimproved water-power on the Campbell river is only a few miles distant.

Salmon River Section.

The Salmon River section is so named because, although there have been no occurrences of metalliferous minerals reported from the immediate vicinity, yet the wharf at the mouth of Salmon river is the point of debarkation to reach the Adams river, on which mineral deposits occur.

Lucky Jim Group.

This group contains three mineral claims known as the *Lucky Jim*, *Lucky John* and *Marjorie*. The group is located on Adams river, which flows into Johnstone strait about fifteen miles north-westerly from the mouth of the Salmon river. The property is reached by means of a poor trail from the junction of the Salmon and White rivers, about seven miles from the Salmon River wharf. The trail follows the east bank of the White river for about half a mile; then takes a south-westerly direction across a comparatively flat country, with several small lakes, beaver meadows, and swamps, for a distance of about ten miles to the headwaters of the Adams river. The property is owned by Alec and Walter McKay, of Vancouver.

Geology.—The rocks on the *Lucky Jim* group are granodiorite and limestone, and occur in a zone of metamorphism in which shearing action has been very pronounced. Several narrow quartz stringers are noticeable in the shear-planes, but none of them appear to carry any mineral.

Characteristics of the Ore-deposit.—The deposit of ore which occurs on the *Lucky Jim* claim of the group belongs to the contact-metamorphic type, with copper minerals occurring at the contact of granodiorite and limestone. The mineralization consists of pyrrhotite, iron pyrite, marcasite, and chalcopyrite in a breccia gangue containing much hornblende and some calcite. Apparently the ore occurs as a partial replacement of the metamorphic rocks in the contact-zone.

The main outcroppings occur in the bed and along the bank of the river, where they show for about 10 feet wide and 50 feet long. The line of strike is north-easterly and dip from 64 degrees to nearly vertical to the south-east. A sample taken from the workings assayed: Gold, 0.9 oz.; silver, 1.8 oz.; copper, 5.35 per cent.

Development-work.—The work on the *Lucky Jim* group of mineral claims is confined to the *Lucky Jim* claim, and consists of a series of prospect-adits driven into the outcrops in the river-bank. The longest is about 70 feet long; the others are each about 10 feet long. The short adits are crosscuts and the long one is presumed to be a drift.

Conclusions.—The examination of this property suggests that, if the transportation facilities were good, instead of being quite difficult, the possibilities are promising, and warrant further development-work, which might result in proving up a mining property of commercial value.

Quadra Island Section.

The Quadra Island section comprises the area of that island, which is the largest of the Valdes group of islands on the east side of Seymour narrows and Discovery passage. The only portions of the island where any activity has been apparent in the mining industry during 1918 have been on the *Copper Mountain* group at the head of Gowland harbour and on the *Santa Anna* group near Bold point, on the easterly side of the island.

The various groups of mineral claims in the vicinity of Granite bay, north of Seymour narrows, have been idle for several years past, except so far as assessment-work having been done on some of the claims that are not yet Crown-granted, but most of the claims in this vicinity have been Crown-granted for some time.

Copper Mountain Group.

This group of mineral claims was reported on in the Annual Report for 1916 and 1917, but is again reported on after another examination made early in November, 1918, which was made because of the reported discovery of deposits of copper ore unknown at the time the examinations were made in 1916 and 1917. The following description of the recent mine-workings on the new discoveries shows that more thorough prospecting is necessary on properties, especially where the shear-zone type of ore-deposits occur, than is often done. This group of claims is one of the oldest locations on the Coast, but it has never been thoroughly prospected until recently.

Location and Area.—The *Copper Mountain* group of mineral claims is located at the head of Gowland harbour, on Quadra island, about 120 miles north-westerly from Nanaimo. The property contains nineteen mineral claims and fractions, named as follows: *Y.Z.*, *Tyee Copper*, *Ingersoll No. 2*, *Hiyu Copper Fraction*, *Ingersoll No. 2 Fraction*, *Senator*, *Hiyu Copper*, *Copper Bluff*, *Copper Dyke*, *St. Lawrence*, *Ingersoll*, *Skookum Copper*, *Copper Mountain*, *Copper Flat*, *Copperopolis*, *Anaconda*, *Copper King*, *Copper Queen*, and *Copper Queen Fraction*. The group covers an area of about 730 acres. It is located from near the shore-line of Gowland harbour in a northerly direction towards the summit of a range of mountains which reach an elevation of about 2,000 feet above sea-level.

Ownership.—The *Copper Mountain* group of Crown-granted mineral claims is owned by the Valdez Island Copper Company, Limited, of Victoria.

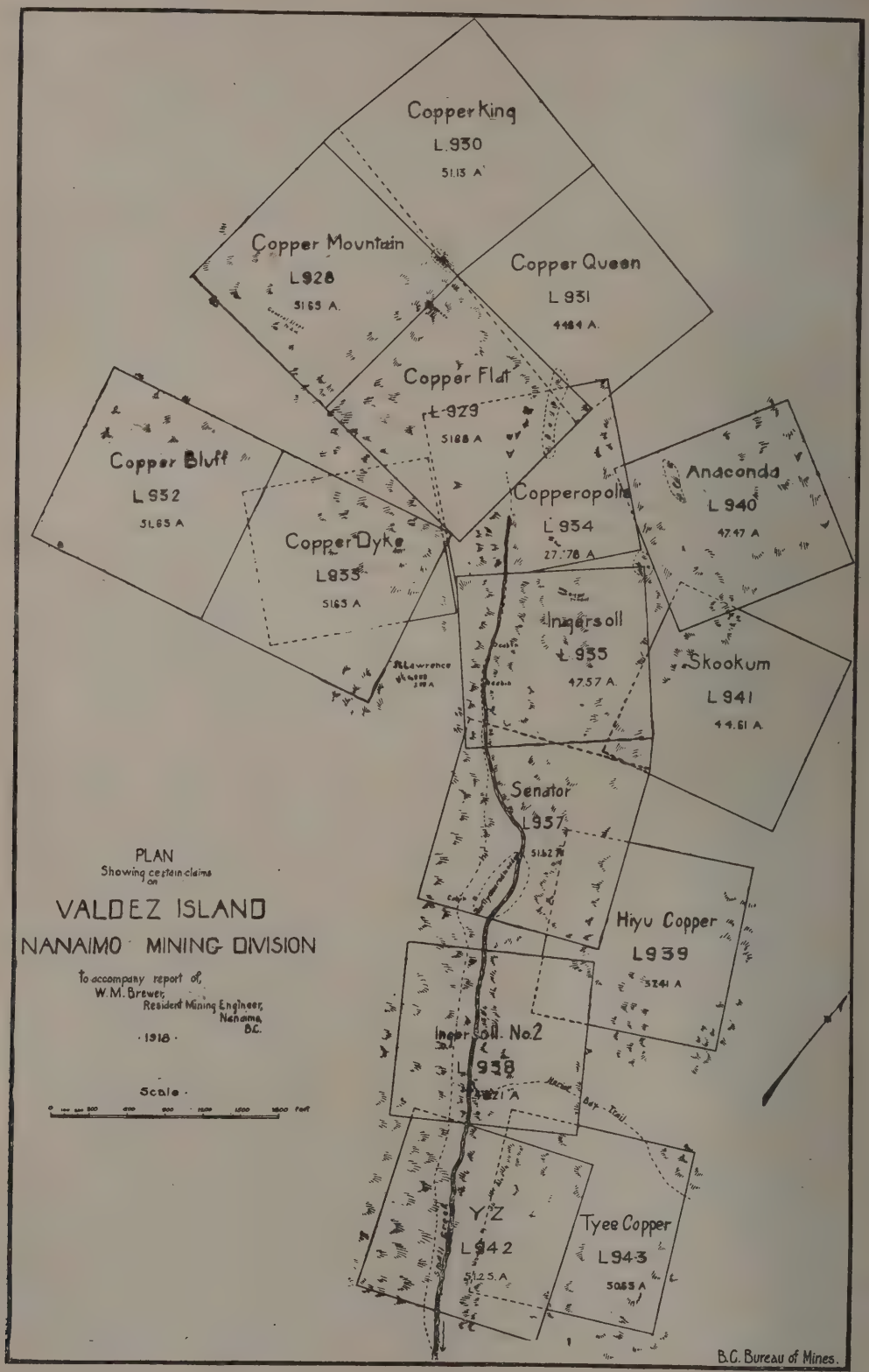
Accessibility.—The property can be reached by three routes, viz.: Esquimalt & Nanaimo Railway from Nanaimo to Courtenay; thence by automobile to Campbell River Post-office and about three miles by launch across Discovery passage to Gowland harbour, Quadra Island. Steamer from Vancouver to Campbell River Post-office and launch across Discovery passage. Steamer from Vancouver to Heriot Bay, a port of call on the east coast of Quadra island, and wagon-road across the island about four miles in distance to Gowland Harbour.

Geology.—The rock formation on the *Copper Mountain* group of mineral claims belongs to the Valdes group of volcanic rocks, consisting of greenstone, andesite, and basalt, with the greenstone generally predominating. These rocks are generally compact and fine-grained to cryptocrystalline in texture; but there are considerable areas where the structure of the rock is amygdaloidal, the amygdules being filled with secondary minerals, such as quartz, chalcedony, epidote, chlorite, calcite, and zeolites. Chalcocite, chalcopyrite, bornite, native copper, and azurite also occur within the amygdules.

The rocks are very much weathered, sheared, fissured, and faulted. The cleavage-planes are generaly slickensided and show the effect of much movement. The surfaces of the weathered rocks are usually rounded and hummocky, with many rounded cliffs and bluffs having steep sides. There is a noticeable system of ridges on the *Copper Mountain* group which trend from the shore towards the north and north-west, and on the surfaces of which the outcroppings of copper minerals found on the property usually occur.

Characteristics of Ore-deposits.—Copper ores, chiefly chalcocite and bornite, occur on several of the mineral claims in the *Copper Mountain* group along joint-planes and shear-zones apparently as isolated deposits of lenticular structure. The deposits that were the most thoroughly prospected in the past have the appearance of blanket or flow structure, and were generally considered by mining engineers as not likely to maintain continuity beyond shallow depths. The outcroppings so prospected showed considerable superficial extent and contained copper ore of high grade. However, during the past season, under the supervision of T. H. Kerruish, other deposits of copper ore have been found which occur on the *Senator* claim. Development-work on this claim shows indications of the ore maintaining continuity on the dip of 38 degrees towards the west to deeper levels than heretofore has been the case. The dip of this ore-body is steeper and in an opposite direction to those mined previous to the past season.

These later discoveries show indications that the origin of the mineralization is from copper-bearing solutions that have ascended along joint-planes and shear-zones in the volcanic rocks, and impregnated those rocks with copper sulphides, especially where amygdaloidal structure occurs in the country-rocks. While the most recent development-work appears to indicate the possibility of the ore having ascended from deep levels, the work had not been carried sufficiently far at the time of the writer's visit during the early part of November to fully determine the question.


Copper King
L.930
51.13 A.
Copper Mountain
L928
51.63 A.
Copper Queen
L 931
44.84 A.
Copper Flat
L 929
51.88 A.
Copper Bluff
L 932
51.63 A.
Copper Dyke
L 933
51.63 A.
Copperopolis
L 934
27.78 A.
Anaconda
L 940
47.47 A.
Ingersoll
L 935
47.57 A.
Skookum
L 941
44.61 A.
Senator
L 937
51.82 A.
Hiyu Copper
L 939
32.41 A.
Ingersoll No. 2
L 938
Y Z
L 942
51.25 A.
Tyee Copper
L 943
50.63 A.
PLAN
Showing certain claims
on
VALDEZ ISLAND
NANAIMO MINING DIVISION
To accompany report of,
W. M. Brewer,
Resident Mining Engineer,
Nanaimo,
B.C.
1918
Scale
B.C. Bureau of Mines.

During 1916 this group of mineral claims was under option to parties who prospected to some extent with diamond-drill, but the boring, so far as the writer can ascertain, with the exception of one flat hole, was done on the blanket deposits, where the mineral-bearing zone appeared to dip towards the east, instead of on the deposits recently found on the *Senator* mineral claim, where the ore-body has a decided dip towards the west, so that the results from the diamond-drilling done at that time have no bearing on the possibilities of the recently found deposits.

The development-work done previous to the summer of 1918 has been confined almost exclusively to the *Ingersoll* claim, with the exception of shallow open-cuts and stripping on the *Copperopolis* and *Copper Mountain* claims. During 1918 most of the work has been done on the *Senator* and *Ingersoll No. 2* claims.

The outcroppings of copper ore on *Ingersoll No. 2* claim are situated about half a mile from the beach on the easterly side of the skid-road at the summit of a rugged ridge, the axis of which trends north-westerly conformably with the strike of the joint-planes in a shear-zone along which copper minerals occur. The outcroppings are found within an area about 100 feet square, where shallow stripping has been done, exposing ore in several places to an average depth of about 4 feet. The cuts were full of broken ore and country-rock. Grab samples taken from two points in the stripped surface assayed as follows: No. 1 sample, where the surface stripped is about 20 feet square, assayed: Gold, trace; silver, 0.4 oz.; copper, 3.2 per cent. No. 2 sample, about 60 feet southerly from sample No. 1, where the stripping is about 30 feet long, 5 feet wide, and 4 feet deep, assayed: Gold, trace; silver, 0.4 oz.; copper, 2.9 per cent.

The outcroppings of copper ore on the *Senator* claim, where the chief development-work has been recently done, occur on a ridge on the westerly side of the skid-road about 1,500 feet in a north-westerly direction from the stripped surface sampled on the *Ingersoll No. 2* claim.

The development-work on November 2nd, 1918, consisted of a deep incline open-cut about 70 feet long, 10 feet wide, and averaging 5 feet deep, but with its maximum depth at the south-easterly end of the cut. About 150 tons of shipping-ore had been mined from the cut previous to the examination. The maximum width of ore is 7 feet.

The ore-body lies between well-defined walls dipping 38 degrees to the westerly and striking nearly true north. The bottom of the cut was still in ore. A grab sample taken from the dump containing about 50 tons of ore sorted for shipment assayed: Gold, trace; silver, 0.4 oz.; copper, 5.6 per cent.

The ore-body is traceable on the surface for some distance south-easterly from the present end of the open-cut, and the superintendent proposes to sink a shaft to test the conditions at depth and abandon the present work of underhand stopping in the open-cut, where water from rain-storms handicaps the mining operations.

On the same mineral claim, but on the opposite side of the skid-road, a narrow seam of copper ore occurs along a fault-plane striking north-easterly and dipping north-westerly about 20 degrees. An open-cut about 10 feet deep and 75 feet long was made on this occurrence of ore by a former management, and all the ore mined was shipped to the Ladysmith smelter. Further prospecting is necessary on this ore-body to determine conditions at depth.

On the *Copperopolis* mineral claim open-cut work and stripping have been done over an area of about 75 feet long and 20 feet wide at a point about 200 feet north-westerly from the old workings on the *Ingersoll* claim. The material blasted out when this stripping was done has been sorted once and the best ore shipped to smelter, but there is a considerable quantity of broken ore mixed with the greenstone country-rock still in the open cuts.

The cuts are so full of broken rock and ore that it is practically impossible to determine the strike and dip of the ore-body, but apparently the strike is north-westerly and dip quite flat, except at the south-easterly end of the open-cut, where the dip appears to be steeper. The width of the ore in the bottom of the trench at that end is only about 12 inches, but the grade is good. A sample assayed: Gold, trace; silver, 0.4 oz.; copper, 8.4 per cent.

Development-work.—The older development-work on the property consists of open-cuts and stripping over considerable areas on the *Copperopolis*, *Ingersoll*, *Copper Mountain*, and *Copper Flat* mineral claims, which was described in the Annual Report for 1916, on pages 346 and 347. The more recent development-work is that done on the *Senator* and *Ingersoll No. 2* claims, described under "Characteristics of Ore-deposits" in this report.

During 1916 a skid-road was built from the beach to the *Ingersoll* claim about a mile and a half long, and a camp built at the beach to accommodate about ten men. It is proposed to extend the skid-road about a mile and a half to facilitate transportation of ore from the *Copperopolis* and *Copper Mountain* claims, also to build cabins on those claims for camps.

Shipments of Ore.—Copper ore has been shipped from the *Copper Mountain* group at irregular intervals since 1917. The transportation facilities when the skid-road is repaired and extended will be excellent. The freight rates to Coast smelters by scows are extremely low, so that even with the decline in the price of copper the property should be worked advantageously.

Phillips Arm Section.

To the north and east of Quadra island there lies a very extensive area composed of small islands and several inlets which penetrate the mainland, as has been already mentioned. Reference to the geological map which accompanies the report of J. Austen Bancroft, issued as Memoir No. 23, "Geology of the Coast and Islands between the Strait of Georgia and Queen Charlotte Sound, B.C.," Canada Department of Mines, 1913, shows the extent of several occurrences of metamorphosed sedimentary rocks which have been intruded by the granite rocks of the Coast range. Such bands of altered sedimentaries are mentioned by Camsell, and described as a series of more or less continuous roof pendants which were not destroyed at the time of intrusion nor removed by later erosion.

Prospecting has proven that gold and copper are found to occur in connection with several of the bands of altered sedimentaries; consequently the section is recommended to the attention of prospectors and investors.

This section is called Phillips arm because of the central location of that arm, as well as because there has been more activity during 1918 in that vicinity than at other points along that part of the coast. The section is intended to include the coast-line from the east side of Bute inlet to the west side of Knight inlet.

During 1918 a syndicate of Victoria men have been operating in the vicinity of Fanny bay, Phillips arm, and a syndicate of Vancouver men are interested in groups of mineral claims on Knight inlet.

Monte Cristo and Amethyst.

Unfortunately the writer was unable to visit these mineral claims during last season while the work was being done; therefore the following particulars were obtained from G. F. Monckton, who superintended the work for the syndicate. The *Monte Cristo* and *Amethyst* mineral claims adjoin, and are near Fanny bay, on the west side of Phillips arm. The property is reached by one of the Union Steamship Company's steamers which stops at Shoal bay, from which point a launch or rowboat can be taken to the shore of Fanny bay.

Characteristics of the Ore-deposit.—With regard to the occurrence of ore on the property, Mr. Monckton says: "The ore-body worked on the boundary of these two claims occurs close to the contact of marble, an andesite dyke, which is in places very schistose. The ore is within a few inches of the marble."

Geology.—Bancroft's description of the geology of this section states that the prevailing rocks in the vicinity of Fanny bay include metamorphosed equivalents of the Marble Bay, Open Bay, Valdes, and Parson Bay formations, in which are included crystalline limestone, argillite, tuff, chert, quartzite, schist, greenstone, andesite, and basalt.

Development-work.—Monckton describes the work done last summer as being a series of open-cuts in the ore-body. One of these is 30 feet long, from 10 to 25 feet deep; another, 18 feet long, 10 feet deep; and a third cut about 7 feet long. These cuts are made partly on the *Monte Cristo* and partly on the *Amethyst* claim.

Monckton further states that while doing this work he has accumulated a dump on which is about 95 tons of ore ready for shipment. With regard to values, he states that "assays from samples carefully taken when there was about 25 tons of ore on the dump gave: Gold, $3; silver, $3." He further states that "an assay from the hanging-wall (right-hand) vein by the Granby Company returned: Copper, 6.4 per cent.; gold, 0.04 oz.; silver, 2.2 oz."

Extent of Ore-deposit.—Monckton's description of the extent of the ore-deposit is as follows: "All of the workings are on the ore-body, which consists of a right- and left-hand ore-streak with mineralized rock intervening, which is usually about 3 feet wide, some of which is sufficiently good to sort out. At the present time the only valuation of it as a whole which can be quoted

is a test of 600 lb. from 6 feet across, made at the Tacoma smelter in 1916, which gave 2.7 per cent. in copper."

Princess Group.

This group of mineral claims contains five claims known as the *Princess Agnes*, *Princess Margaret*, *Princess Charlotte*, *Princess Ethel*, and *Princess Jessie*. The *Princess* group is located on Knight inlet about twenty miles easterly from Minstrel island, near Glendale cove. The Princess Copper Mines, Limited, of British Columbia, is the owner, with John Walker and John Carmichael, of 714 Dominion Building, Vancouver, representatives.

Owing to the inability of the writer to arrange to visit this property when the operators were at work in 1918, no examination has been made of it, but arrangements have been made for an early visit in 1919. Specimens of the ore said to have been obtained from the claims show that it is chiefly bornite in a garnetite and limestone gangue.

Texada Island Section.

Texada island has been described so frequently in former reports, as well as in the memoirs and summary reports of the Geological Survey, that it is unnecessary to give any detailed description in this report.

During the past season the mining operations on the island have been confined to those at the *Marble Bay*, *Loyal*, *Retriever*, *Davies Bay*, and *Good Hope* metalliferous properties, and the Blubber and Marble Bay limestone-quarries. The island was visited for about a week from November 8th.

Marble Bay.

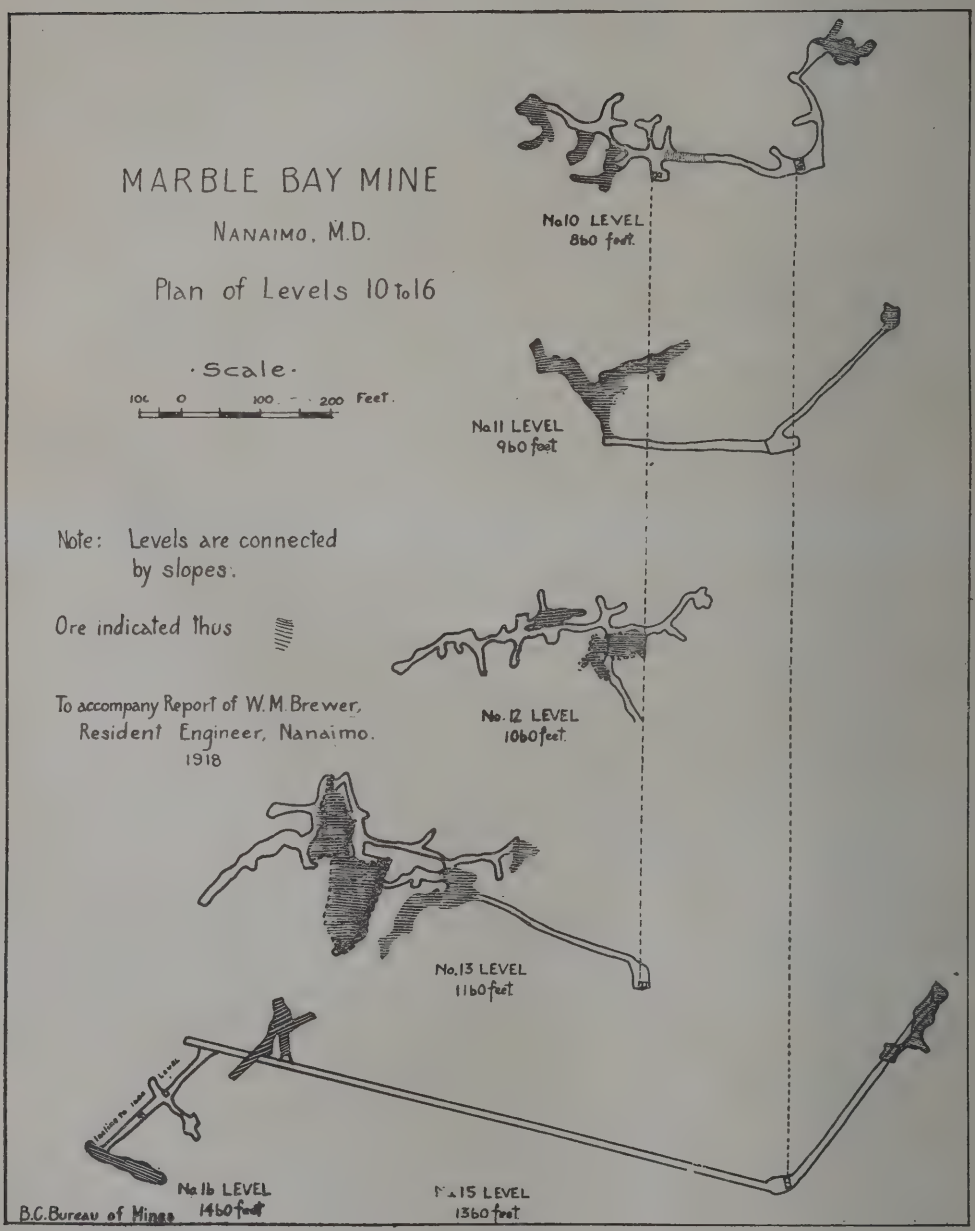
Mining operations have been carried on continuously at this mine during 1918, and regular shipments of copper-gold ore have been made to the Tacoma smelter approximating 10,000 tons.

Development-work.—The development-work during 1918 has been confined almost entirely to opening-up the 1,600-foot level, which is about 1,500 feet vertically below the surface and about 1,400 feet below sea-level. Diamond-drilling has been done to explore the ground below the 1,600-foot level on the westerly side of the incline winze from the 1,500-foot level. These drill-holes show large bodies of garnetite; one of these bodies is shown by the drill-core to be persistent for about 100 feet in a hole bored on a 26-degree angle from the floor of the 1,600-foot level. The core also shows some narrow stringers of bornite in the garnetite, which is considered by the management as quite encouraging, because in the upper levels in the mine this variety of copper ore is nearly always found in association with garnetite or tremolite. Another hole is being bored at an angle of 40 degrees, and other holes will be bored at varying angles, as it has been found by the management, in locating the ore-bodies on the upper levels that it is advisable to bore several holes spread out like a fan from a common centre in order to determine as closely as possible whether the ore exposed in the drill-holes is of sufficient extent to warrant driving working openings.

August 8th, 1918, was the date on which a start was made to draw ore from the stope on the 1,600-foot level, and at the time of examination the top of the stope was about 40 feet above that level by vertical measurement, with some high-grade bornite in the roof of the stope. Since that examination the writer is advised that the stope has been mined out, and that the ore did not extend through to the floor of the 1,500-foot level. This ore-body was 110 feet long and averaged from 8 to 12 feet wide. At one part of the stope the ore showed a maximum width of nearly 45 feet. The dip of this ore-body is 35 degrees to the north-westerly, but it shows in the roof and floor of the 1,600-foot level dipping much flatter.

The collar of the incline winze from the 1,500-foot level is near the face of the north-west drift, 700 feet from the main shaft. The winze is 125 feet deep on a 45-degree angle.

The main shaft is sunk vertical from the surface to the 1,500-foot level, with stations about 100 feet apart down to the tenth level, but with no stations between that level and the fifteenth. The reason for this is that the ore-body on the north-westerly side of the shaft below the tenth level has pitched or dragged so far from the shaft that it was deemed advisable to sink a vertical winze from the tenth level and hoist the ore through the winze; then tram it to the main shaft and hoist to the surface. This course was pursued until it was found that the ore-body was persistent below the thirteenth level, when it was considered more economical to sink the main shaft to the fifteenth level and hoist all ore from that level to the surface direct instead of making a transfer on the tenth.


MARBLE BAY MINE
NANAIMO, M.D.
Plan of Levels 10 to 16
·Scale·
100 0 100 200 Feet.
No.10 LEVEL
860 feet.
No.11 LEVEL
960 feet
Note: Levels are connected by slopes.
Ore indicated thus
To accompany Report of W.M. Brewer, Resident Engineer, Nanaimo. 1918
No. 12 LEVEL
1060 feet.
No.13 LEVEL
1160 feet
No.16 LEVEL
1460 feet
No.15 LEVEL
1360 feet
B.C. Bureau of Mines

On the fifteenth level there is a drift toward the south-east 300 feet long to the ore-body in that direction from the main shaft, which is persistent from the ninth level almost to the fifteenth, or to what is known as the "1,502" stope. There was no ore in the face of this drift on the fifteenth level, nor was any ore exposed in the drift itself.

The accompanying sketch shows how erratic the ore-bodies have been in their occurrence, and yet when the formation is carefully studied there is a certain regularity and indications which when followed result in the discovery of extensions of the known ore-bodies or in finding new ones.

Loyal Group. This group of mineral claims has been worked spasmodically since the discovery of ore occurrences in 1900, when the mine was opened by the Van Anda Copper and Gold Company, but since that company stopped operations work has only been done at intervals by lessees, and during 1918 it has been operated by Thomas Davis, of Seattle.

Development-work.—The development-work done on the property previous to the past year consisted of five shafts, the deepest being 300 feet, known as the No. 1 shaft, which is sunk near the south-east face of a deep open-cut from which ore was quarried when the mine was first opened. The No. 2 shaft is about 220 feet south-easterly from No. 1 and is about 200 feet deep. The No. 3 shaft is about 180 feet distant from the No. 2 and is about 220 feet deep, on an incline toward the west. The other two shafts are shallower and were sunk for prospecting at points between Nos. 1 and 3. All of these shafts are sunk in a mineralized zone made up of altered felsite and garnetite, which contacts with limestone on both the easterly and westerly sides, and in which occurs outcroppings of bornite and some chalcopyrite in the garnetite gangue.

During 1918 the lessee has renewed the gallows-frame over the No. 1 shaft and installed a compressor plant and pump, and began prospecting the underground workings from that shaft. Finding that the pump was unable to handle the water below the 200-foot level, a bulkhead was constructed to hold the water back and the ground above that level prospected.

On the 200-foot level there is a drift toward the north about 300 feet long. An upraise was made in ore by the lessee from this drift to the 100-foot level, but the ore was a pipe about 10 feet long that extended up to and above the 100-foot level. This pipe was stoped out in making the upraise and yielded about 70 tons of ore that assayed: Gold, trace; silver, 5.0 oz.; copper, 4.5 per cent.

After this work was done the lessee closed down work for the winter, and proposes to resume next spring and prospect on the 100- and 200-foot levels in a southerly direction from the No. 1 shaft under the mineralized zone which outcrops on the surface. No prospecting has ever been done in that direction in the underground workings, although it would appear as though such prospecting ought to result in exposing ore-bodies similar to those which outcrop. In a northerly direction from the No. 1 shaft there are no outcroppings on the surface, where the prevailing rock is limestone which has been intruded by a series of dioritic dykes. One of these dykes occurs about 80 feet northerly from the No. 1 shaft, striking N. 80° W. (mag.) and dipping 80 degrees to the south (mag.).

Good Hope. This mineral claim on Raven bay, on the east coast of Texada island, owned by H. Walbran, of Vananda, was examined in 1917 and described in the Report of the Minister of Mines for that year, but during 1918 it has been operated and about 1,000 tons of magnetite shipped to the blast-furnace at Irondale, State of Washington. When examined in November, 1918, the miners were quarrying the ore from an open-cut about 20 feet deep at the face, 20 feet wide, and 22 feet long. This open-cut was made diagonally across the strike of the ore, which is south-easterly, with the dip 81 degrees toward the east.

The working force consisted of an average of eight miners, who quarried about 50 tons a day and loaded it on scows at the rate of about 40 tons an hour. The quarry is connected with the shore by a gravity-tramway 140 feet long to ore-bins 17 feet high, 16 feet wide, and 24 feet long. From the bins there are two trestles branching off, each 150 feet long and 14 feet high, to permit scows to lie on two gridirons, each 80 feet long and 34 feet wide, so that two scows can be loaded at once. A grab sample of the ore being shipped assayed: Iron, 60 per cent.; phosphorus, 0.08 per cent.; sulphur, 0.03 per cent.; silica, 5 per cent.

Retriever. This mineral claim, which is owned by W. H. Lee and Wm. McDonald, of Vananda, and is on Surprise mountain, on the westerly coast of Texada island, was actively operated during 1918. This property was described in the Report

of the Minister of Mines for 1917, page 258, but since then there has been a concentrating-mill built on the shore at the terminus of the 1,850-foot aerial tramway. The mill is equipped with an ore-crusher, two sets of rolls, two Faust jigs, and concentrating-table with a capacity to handle about 50 tons of ore a day. In November, at the time of the writer's visit, the mill had not been started owing to the lack of water because of the extremely dry season.

There was about 60 tons of ore in the bunkers from the vein known as the "sulphide" vein. A sample was taken from a new shaft started on the silver-lead vein, about 100 feet north-easterly from the old shaft on the silver-lead vein. A grab sample from this shaft assayed: Gold, trace; silver, 0.4 oz.; copper, 0.5 per cent.; and a sample from the bottom of the old shaft on the sulphide vein assayed: Gold, trace; silver, 2 oz.; copper, 13 per cent.

Stromberg Group.

This group of mineral claims is near Davies bay, on the west side of Texada island, and is owned by Wm. Stromberg, of Vananda. The group contains seven claims, known as *Edith*, *Kate*, *Deloro*, *Hill*, *Ethel*, *Boulion*, and *Big Bluff*. The property is bonded to York & Young, of Seattle, who are prospecting it by a crosscut adit which is expected to develop an ore-body at a depth of about 50 feet that outcrops on the surface.

Comox Section.

The Comox section of the Nanaimo Mining Division contains the Cumberland coalfield and is the site of some of the collieries operated by the Canadian Collieries (Dunsmuir), Limited, which are fully dealt with in the report of Henry Devlin, Inspector, on other pages of this Annual Report of the Minister of Mines. The section would not have been referred to by the writer, except on account of his having visited Cumberland on October 20th, 1918, in order to make an examination of some lode-mineral claims which had been described as possessing much merit and located near the town.

Ypres Group.

This group of mineral claims contains the *Ypres*, *Cavell*, *Somme*, and *Verdun* claims, which are owned by A. E. Howard and associates, of Cumberland.

Geology.—A short distance south-westerly from the town of Cumberland there occurs the change from the coal-measures to the volcanic rocks that form the Beaufort range of mountains, which traverses Vancouver island nearly its entire length. It is on the north-easterly side of this range that the *Ypres* group of mineral claims is located, along a steep ridge of volcanic rocks in which occasionally can be seen a few specks of native copper. The rocks are considerably sheared and in some places fissured, but the writer could not find any defined ore-deposit, nor are the fissures filled with any gangue material.

After occupying some time around the adit, described later, in an endeavour to find a sample that would appear to carry values, one was taken of the most promising-appearing material, which assayed: Gold, trace; silver, trace; copper, trace.

Development-work.—There is an adit on the *Verdun* claim 30 feet long, 9 feet wide, and nearly 7 feet high. The course of the adit is southerly along the strike of the shearing-planes. Apparently the work had been done a long time ago. No other work could be found by James Dick, who was guide for the trip.

Tsaabl River Coal.

The Tsaabl river, which is also locally known as the Baynes Sound river, flows into Baynes sound about five miles southerly from Union bay and opposite to Denman island. About five miles up the Tsaabl river there occurs an outcrop of coal in the river-bed. The strike of the seam is northerly and the dip westerly. There is a very uniform sandstone roof to this seam of coal. The sandstone is found to occupy an area of about four miles along the strike and two miles wide.

The following is a section of the seam of coal:—

	Ft.	in.
Roof sandstone.		
Black shale	1	0
Coal	1	3
Soft-shale parting	0	2
Coal	2	2
Soft-shale parting	0	4
Coal	3	6
Total coal	6	11

This seam of coal occurs on the property of the Canadian Collieries (Dunsmuir), Limited, and during the autumn of 1918 that company started to construct a wagon-road from the main coast road up the Tsaabl river in order to haul in a diamond-drilling outfit to prospect the field.

Canadian Collieries (D.), Ltd.

During 1918 this company has made the following improvements at its No. 4 mine, Cumberland: Driven a new entrance to the main slope, the portal of the new adit being 15 feet higher than the old entrance to the slope. The new adit is driven directly over the old slope, and reduces the mining costs, because the use of tail-ropes is eliminated to haul empties back from the long flat from the top of the slopes. A new tipple with a capacity to handle 1,000 tons of coal a day and equipped with a Marcus screen is being built at the No. 4 mine.

Nanaimo Section.

In the Nanaimo section of the Nanaimo Mining Division there have been two new coal-mines opened during 1918. These are the No. 5 mine at South Wellington, owned by the Canadian Collieries (Dunsmuir), Limited, which has produced about 28,787 tons since the plant was completed in September, 1918, and the Wakesiah, owned by the Canadian Western Fuel Company, Limited, on which development had not progressed far enough to place it in the producing class during the past year.

The mining industry in the Nanaimo section of the Nanaimo Mining Division is confined entirely to coal-mining, except in two localities where shale is quarried for manufacturing pressed brick. The section as considered in this report includes the Nanaimo collieries proper, the South and East Wellington collieries, and the Gabriola shale-deposits.

The Nanaimo collieries, which include the No. 1 Esplanade shaft in the city of Nanaimo, the Harewood and Reserve mines within a short distance from the town, produced during 1918 about 731,922 tons of coal, the greater proportion of which was mined from the No. 1 shaft. Although this mine has been producing for many years and is the oldest regular producing coal-mine in the Province, it still retains the position of leader in production over any other single mine in the entire Province, although the aggregate production from all of the mines of the Canadian Collieries (Dunsmuir), Limited, exceeded that from the Nanaimo group.

The oldest coal-mine in the Province is at Suquash, near the north-easterly end of Vancouver island. This mine was opened by the Hudson's Bay Company about two years before coal was discovered at Nanaimo, but has not been actively operated, except intermittently, since that company suspended operations. It is at present owned by the Pacific Coast Coal Mines, Limited, of Victoria, but has not been operated during 1918.

The Nanaimo collieries have been the means of building up the second largest city on Vancouver island and about the fourth in the Province.

Canadian Western Fuel Co., Ltd.

This company is opening a new mine called the "Wakesiah," on the Wellington seam. This mine is located on the company's farm, about a mile and a half from the Esplanade shaft. A main shaft and an air-shaft have been sunk to coal, and connection made between the two shafts. Coal is reached in the main shaft at a depth of about 325 feet. The estimated cost of the plant at the mine, railway connecting the mine with the wharves, bunkers on the water-front at Nanaimo, and initial development is about $200,000.

Prospecting for coal with a diamond-drill has been done by the Canadian Western Fuel Company, Limited, near Chase river, also on the company's farm, West Nanaimo, and at other points.

Except for the epidemic, which was very serious during the last quarter of 1918, the Canadian Western Fuel Company, Limited, would have established a record during that year, but owing to the influenza there was not more than two-thirds of the normal force of miners working from early in October and for about six weeks afterwards.

In the old coal-mines the development-work has been carried on as extensively as circumstances permitted. The chief improvements made during the past year are as follows:—

The Canadian Western Fuel Company, Limited, installed a new power-engine (1,300-kw. direct-current generator) at the No. 1 Esplanade mine to replace the generator formerly in use. At the Harewood mine the same company installed the following additions to the former plant: 1,200-kw. generator, two 150-horse-power boilers, and new screening plant. The total estimated cost of the above improvements is about $42,000.

Canadian Collieries (D.), Ltd.

This company, after having completed the preliminary work commenced in September, 1917, opened the No. 5 mine at South Wellington down to the Douglas seam, and began producing coal during the summer of 1918. Coal was first exposed by a prospecting-shaft 5 x 5 feet, 90 feet deep. A slope was later enlarged to 10 x 12 feet for a ventilating-shaft. A slope has been driven 2,200 feet, which intersects the coal-seam 60 feet south of the prospecting-shaft. Levels to the north and south have been driven at 300 centres. The coal, which is of very good quality, varies in thickness from 2 to 12 feet. The estimated capacity of the mine is about 90,000 tons of coal per annum.

Gabriola Is. Shale-deposit.

The Gabriola Island Shale Product Company, Limited, has succeeded the Dominion Shale Product Company, Limited, and with D. W. Campbell, of Victoria, as superintendent is manufacturing a high-class pressed red brick, which finds a ready market in Vancouver and other points. The Gabriola Island shale is not referred to at any length by Ries and Keele in their report on the clay and shale deposits of the western Provinces, published by the Canada Department of Mines in 1912, but is mentioned by Chas. H. Clapp in Memoir No. 51, "Geology of the Nanaimo Map-area," Canada Department of Mines, 1914.

Clapp classifies the shale on Gabriola island as belonging to the Northumberland formation of the Nanaimo series, underlying the Gabriola formation, which is the uppermost formation of the Nanaimo series. The Northumberland formation consists of shales, sandstones, and conglomerates, with shales occurring at the top and bottom of the formation and virtually confined to those horizons. The shale-deposit which is being worked by the Gabriola Island Shale Product Company belongs to the bottom part of the Northumberland formation, and occurs on the north-easterly shore of False narrows, near the south-westerly end of Gabriola island.

Gabriola island is east of Nanaimo harbour and separated from Vancouver island by Northumberland channel. The island is a synclinal ridge about eight miles long and from two to three miles wide. Clapp calculates the thickness of the bottom bed of shale in the Northumberland formation, together with thin beds of sandstone, as being 510 feet, and describes the shales as "grey, sandy"; but from the fact that the shales on the property of the Gabriola Island Company are bluish and brownish in colour, and in actual commercial practise show good plasticity, it would appear that his examination was confined chiefly to the north-westerly end of the island around Descanso bay.

The quarry, which is partly an open-cut and partly an incline pit from which the shale is being mined by the Gabriola Island Shale Product Company, Limited, is about 125 feet long, extending back into a ridge, with the face about 35 feet high at the north-easterly end of the quarry, which is the widest part and where the floor is practically level. The south-westerly end of the quarry is a pit about 20 feet deeper than the floor at the other part. This end of the quarry is not being worked at present owing to the accumulation of water and necessity for pumping, which is avoided at the north-easterly end.

The following analyses were made from samples of the shale used in the brick-making machines at the time the writer made an examination on December 30th, 1918:—

	Blue Shale. Per Cent.	Brown Shale. Per Cent.
Silica	55.6	56.4
Ferric oxide	10.1	9.37
Alumina	20.0	20.1
Lime	Trace	Trace
Magnesia	0.3	0.3
Sulphur	0.1	0.15
Alkalies	4.9	4.28
Ignition	9.0	9.4

(Suitable for paving-brick, sewer-pipe, etc.)

The brick-making plant consists of a Bird press, capacity 20,000 bricks a day; a Bird dry-pan crusher and fan of the 50-inch Sheldon type, which revolves 300 revolutions a minute and is used to provide artificial ventilation in the semi-continuous kiln, 148 feet long, 42 feet wide, and 10 feet high. The kiln has horizontal draught and is divided into ten chambers, each chamber having a capacity to hold 22,500 bricks. There is a dryer 100 feet long divided into five chambers in which the bricks are placed after leaving the press, and in this dryer the bricks are dried. The heat

Side View of Tipple, Cassidy Colliery.

End View of Tipple, Cassidy Colliery.

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in the dryer is transmitted from fire-boxes at the north end through cast-iron pipes 12 inches in diameter. The machinery in the plant is driven by steam generated in a 100-horse-power boiler.

The transportation facilities are admirable owing to the fact that the plant is on the shore in a perfectly sheltered harbour, where scows can lie for loading at all seasons, and the further fact that the deposit of shale is close to the plant. Tugs must tow scows from the wharf at high tide, because the shore on this part of Gabriola island has such a gradual slope that it is a considerable distance to water sufficiently deep to accommodate vessels of deep draught.

E. Wellington Shale-deposit.

The Nanaimo Pressed Brick and Terra Cotta Company, Limited, is located at East Wellington, and was organized to work the shale-deposits which occur in that part of the Nanaimo section of the Nanaimo Mining Division. These shales are referred to in Clapp's Memoir No. 51 as belonging to the Haslam formation, locally called "Marine shales," of the Nanaimo series, which overlies the Benson conglomerates. The Benson conglomerate is the basal conglomerate of the Nanaimo series. The shale mined by the company at East Wellington is found in the upper part of the Haslam formation. The pressed brick made by the company is excellent in quality, but the location of the works is a handicap, because of the product having to be shipped over two railroads and the high freight rate charged by each of these, which makes competition with brickyards more favourably located very difficult.

Cassidy Subsection.

The Granby Consolidated Mining, Smelting, and Power Company, Limited, which started the preparatory work of opening a coal-mine at Cassidy, about eight miles southerly from Nanaimo, in 1917, by prospecting with a diamond-drill, was satisfied with the results and started sinking the main slope on March 7th, 1918. The mine is now opened by three slopes—the manway, hoist, and return airway—and a limited quantity of coal is being hoisted daily, but the proposed plant is not expected to be completed for about a year and a half. The estimated cost of the completed plant, including railway connection with the Esquimalt & Nanaimo Railway, coal-washer, houses for staff, miners, and workmen, is approximately $1,000,000, when the capacity of the plant will reach about 250,000 tons of coal per annum. The maximum thickness of the coal-seam is 12 feet.

The model town that has been built by the Granby Company at Cassidy is a very noticeable feature of the improvements made by the company during the past year. About 50 acres are cleared for the site of the company's camp, mining plant, and tipple, as well as for residences for the superintendent, mine manager, firebosses, accountants, and storekeepers, and the large dining-room, wash, shower-bath, drying-rooms, and bedrooms for the miners.

As full details with regard to the colliery are contained in Inspector Devlin's report for 1918, published in the Annual Report of the Minister of Mines for that year, it is needless to repeat the details here.

The equipment in all of the buildings is of the most modern character and nothing has been left undone that can possibly tend to add to the comfort of the employees.

Redonda Island Section.

The Redonda Island section of the Nanaimo Mining Division includes the group of islands of that name situated near the entrance of Toba inlet, about 110 nautical miles north-westerly from the city of Vancouver. So far as this report is concerned, the island known as West Redonda is the only one of the group examined in 1918, because it is the only one on which any occurrences of mineral deposits have been reported.

In order to reach the part of the island on which mineral occurs it is necessary at present to travel by private launch from Vancouver, as although one of the Union Steamship Company's vessels calls at Deceit Bay Cannery, about three miles from the mineral deposits, the calls are only made once a week, and it is difficult to secure transportation from the cannery around to Pryce channel, the western boundary of the island and the starting-point to the deposits of magnetite.

Pryce channel has very deep water to within a short distance from its steep rocky shore; consequently the anchorage is insecure and landing from small boats is often difficult and sometimes almost impossible.

Elsie. This mineral claim was staked many years ago, and a shipment of about 600 tons of magnetite ore was made to an iron blast-furnace in Oregon. The claim was worked and Crown-granted about 1885. The claim is located on the west side of West Redonda island, on the slope of a very steep mountain which reaches an elevation of about 3,000 feet within quite a short distance from the shore. The claim is staked from the shore in a southerly direction, starting from the mouth of a small torrential unnamed stream which flows through a box canyon for a considerable distance. The trail up the mountain-side has a grade of nearly 45 degrees. The claim is owned by the estate of the late John Hendry, of Vancouver, the trustee of which is the British Columbia Milling, Timber, and Trading Company, of Vancouver.

Geology.—The rock formation on the *Elsie* claim is principally a green igneous rock that may be called a greenstone until properly classified from a microscopical examination. Intruding the greenstone are well-defined dykes of a blackish-coloured igneous rock. One of these dykes forms a prominent geologic feature on the shore at the mouth of the creek referred to. Associated with the greenstone are contact-metamorphic rocks, indicating the occurrence of a belt of limestone within a short distance, but no actual contact between limestone and greenstone could be found. The greenstone is considerably sheared and altered, with the strike of the shear-planes being in a southerly direction, conforming with the strike of the intrusive dykes, and the dips usually nearly or quite vertical, with any incline being at about an 80-degree angle towards the east (mag.).

Characteristics of Ore-deposits.—Two deposits of magnetite ore are reported as occurring on the *Elsie* claim, but owing to lack of trails the writer was only able to find one of these, which occurs on the northerly slope of the mountain at an elevation of about 400 feet, and by horizontal measurement about 700 feet from the shore. The deposit examined apparently fills a wide fissure in the greenstone country-rock and is continuous up the mountain-side an undetermined distance. This deposit belongs to the replacement type in a fissure in a shear-zone in a greenstone gangue, where the magnetite replaces altered rocks in the contact-metamorphic zone which appear to carry much limestone.

The deposit of magnetite is about 30 feet wide in the face of an old open-cut from which the shipment of ore, made several years ago, appears to have been mined. The open-cut itself is about 50 feet long, crosscutting the ore-body from east to west, and the face of the open-cut is about 30 feet high. On both the east and west sides of the open-cut there are about 10 feet where the ore is mixed with country-rock, while the remaining 30 feet is practically solid ore. A grab sample taken from the face of the open-cut assayed: Iron, 60.6 per cent.; phosphorus, trace; sulphur, trace; silica, 5 per cent.; titanium, *nil.*

Development-work.—The open-cut referred to is the only development-work that could be found. It is said that a cabin was built on the claim, also an ore-chute was constructed from the mine-workings to the beach, but no evidence of either cabin or chute remains to-day, except an occasional piece of timber and a platform that apparently was the upper terminal of the chute.

Black Warrior Group. This group contains the *Eagle*, *Iron Cliff*, *Black Warrior*, *Homestake*, and *Bonanza* mineral claims. The group is staked from the shore of Pryce channel easterly from the *Elsie* mineral claim, including about 4,500 feet along the shore-line in an easterly direction, and extending up the northerly slope of the precipitous mountain range for about 3,000 feet horizontal measurement.

Geology.—The rock-formation on the *Black Warrior* group is chiefly igneous, but with a belt of limestone on the easterly portion of the group, as well as zones of contact-metamorphic rocks in which occur much epidote and garnetite.

There are two creeks, Eagle and Homestake, which have their sources near the summit of the mountain range, with its elevation about 3,000 feet. These creeks flow down the northerly slope of the mountains with an average grade of about 30 degrees, and steeper in many places. Both of these creeks flow for considerable distances through box canyons with banks 100 feet and more high.

The igneous rocks vary from a light-coloured rock with close-grained porphyritic structure to a deep green massive rock resembling the greenstone on the *Elsie* claim already referred to. All of the rocks show much alteration, shearing, fissuring, and fracturing, and favourable conditions for the deposition of ore.

Characteristics of Ore-deposits.—There are at least two prominent deposits of magnetite occurring on the property, one close to the No. 1 post of the *Black Warrior* mineral claim and the other near the westerly boundary of the *Homestake* mineral claim. There are other outcroppings of magnetite occurring near the deposits referred to, but apparently these possess but little commercial value as compared with the two first mentioned, which appear to contain very considerable tonnages of ore immediately available for mining.

The *Black Warrior* deposit is about 1,300 feet from the shore at an elevation of about 300 feet. It outcrops in the steep bank of Eagle creek, where a short prospecting-adit has been driven along the west wall of the ore-body and an open cut made across the outcropping. This work shows that the solid ore is 14 feet wide, nearly 50 feet high, and apparently maintains continuity into the mountain an undetermined distance, which cannot be ascertained until stripping the surface has been done. The deposit belongs to the contact-metamorphic replacement type, where the magnetite has replaced the metamorphic rocks. A sample chipped across the width of the face of ore 14 feet wide assayed: Iron, 64.8 per cent.; silica, 5 per cent.; phosphorus, trace; sulphur, trace; titanium, *nil.*

The deposit of magnetite on the *Homestake* mineral claim is exposed in the bed as well as on the precipitous banks of Homestake creek, which was filled with a snowslide at the time the examination was made, and the most of the outcroppings were covered by about 10 or 12 feet of snow; consequently no particulars as to extent of the deposit could be obtained, neither could any samples of the ore be taken.

Apparently the deposit belongs to the contact-metamorphic replacement type, although the ore-body, where it outcrops, does not occur at the actual line of contact between limestone and igneous rocks, but at some little distance away. The country-rock on the creek-banks, where not covered with snow is seen to be highly metamorphosed and indicates the occurrence of a zone of contact metamorphism of considerable extent. From information received from N. Humphreys, B.C.L.S., who surveyed the group, the outcrop of magnetite covered by snow on the *Homestake* claim is about 60 feet wide.

NEW WESTMINSTER MINING DIVISION.

The New Westminster Mining Division occupies an area on the Mainland roughly triangular in shape, with its southern boundary extending along the International Boundary-line, along the 49th parallel from the Strait of Georgia on the west, to the range of mountains forming the watershed between the Chilliwack and Skagit rivers on the east; its eastern boundary is formed by the western boundary of the Yale Mining Division to the point where that Division adjoins the Lillooet Mining Division near Skookumchuck, on the Lillooet river, about twenty-five miles north of Port Douglas; its northern boundary adjoins the southern boundary of the Lillooet Mining Division to the summit of the range of mountains easterly from Green lake, on the Pacific Great Eastern Railway; its western boundary follows the summit of that range of mountains southerly to the head of Burrard inlet, thence south-westerly to the 49th parallel and point of beginning. The area contained within the boundaries is occupied principally by the Coast range, except that part of the Mining Division which forms the delta of the Fraser river and the narrow valleys of the Pitt, Stave, Chilliwack, and Lillooet rivers.

The Division has been comparatively only scratched over so far as prospecting for lode minerals is concerned, but this condition is accounted for to a great extent by the fact that the granodiorite of the Coast range has not been considered a favourable formation by the average prospector in which to find occurrences of the precious or base minerals. The fact that bands and belts of metamorphosed sedimentaries occurred, which had not been removed or destroyed when the plutonics intruded into the older sedimentary formation, has not been generally recognized by the average prospector until within a quite recent time.

The New Westminster Mining Division for convenience has been subdivided in this report into three sections, as follows: Cheam Range, Agassiz, and Stave River sections.

Cheam Range Section.

The Cheam Range section is so called because the mineral claims in this section of the New Westminster Mining Division are located in the range of mountains known by that name and which form the divide between the Fraser and the Chilliwack rivers. There are several peaks in this range of mountains which reach elevations as high as 6,000 feet above sea-level, and it is near some of those peaks that the most important groups of mineral claims, so far as

at present known, are situated. Several quite extensive glaciers have formed along the summit of the Cheam range, especially on the north slopes, and these have necessarily retarded prospecting and made development-work difficult to do, as well as interfering with the construction of transportation facilities.

The transportation facilities at present provided is the Canadian Northern Pacific Railway, which is built along the northerly base of the mountain range; but on the southerly slope there are no up-to-date transportation facilities, except an old wagon-road along the bank of the Chilliwack river, which is so located as to be a costly road to keep in good repair, as well as increasing the distance to rail from the mineral claims by about fifteen miles. This latter route, though, can be vastly improved and the distance reduced, which will permit of commencing work much earlier each season than is possible by the route on the northerly slope from the railway to the groups of claims.

Lucky Four Group

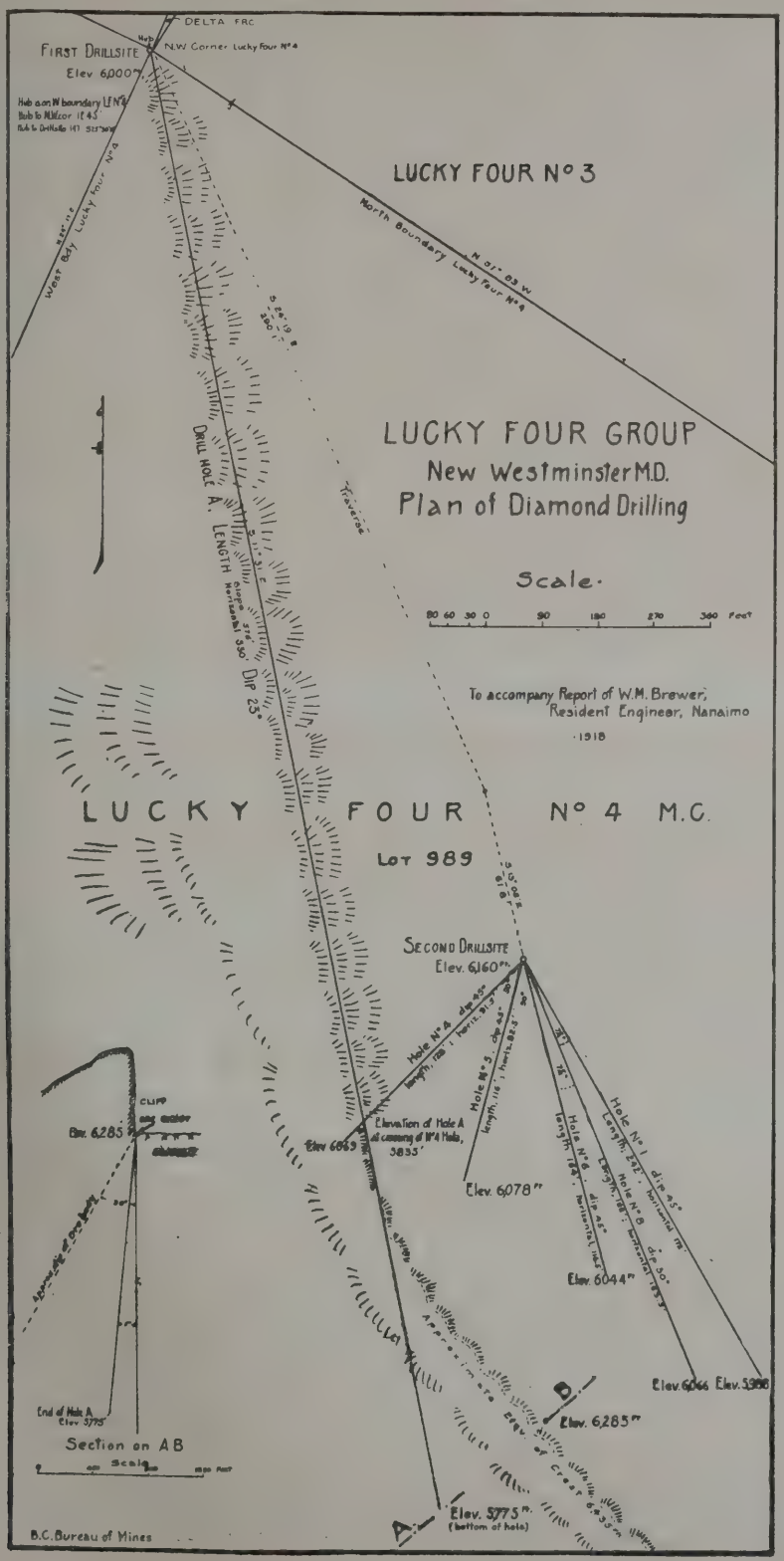
This group of mineral claims is located at the summit of the Cheam range of mountains overlooking Wahleach (Jones) lake and creek to the north, and Ford creek, a tributary of the Chilliwack river, to the south. The elevation is from 5,000 to 6,000 feet above sea-level. There are eleven mineral claims and seven fractional claims in the *Lucky Four* group, named as follows: *Lucky Four No. 1, No. 2, No. 3; No. 4, No. 5, No. 6; Lucky Jack No. 1, No. 2, No. 3, No. 4; Alpha, Phee Fraction, Pi Fraction, Gamma Fraction, Epsilon Fraction, Beta Fraction, Delta Fraction,* and *Vimy Fraction.* These occupy an area of about 700 acres. The group is owned by White & Sperry, of Seattle, who acquired the property by purchase from the original locators in 1916.

History.—Some years ago one of the caretakers employed by the British Columbia Electric Railway in connection with the water-power on Wahleach creek found many lumps of almost pure chalcopyrite, as float, in the bed of Wahleach creek between the head of Wahleach lake and a big glacier on the northerly side of the Cheam range of mountains, but was unable to locate the source. During the summer of 1915 a party of prospectors left the town of Hope to prospect the mountains westerly from the head of Silver creek towards Mount Cheam. This party found outcroppings of chalcopyrite near the foot of the glacier, as well as near the summit of the range, and staked the *Lucky Four* group of mineral claims, to which the other claims now included in the property were later added. The attention of mining engineers was attracted by the high grade of the samples that were brought to Hope. Some of these visited the locations, and their reports were followed by the bonding of the claims by A. S. Williamson, of North Vancouver, for his principals, Sperry & White, of Seattle.

In order to prospect the ground it was decided to install a diamond-drilling outfit on the glacier and bore through the ice in an endeavour to ascertain whether ore occurred under the glacier. A pack-trail was constructed from near the mouth of Wahleach creek, on the Canadian Northern Pacific Railway, during the early spring of 1917, when the depth of snow was very considerable, and the diamond-drill and gas-engine were hauled into position on the glacier. The prospecting-work resulted satisfactorily, but the difficulties that would attend carrying on mining operations under the glacier were practically insurmountable, so Mr. Williamson, who had superintended the trail-work and drilling, commenced a thorough prospecting for a continuation of the mineralized zone over the summit of the glacier and down the southerly slope of the mountain range. He succeeded in locating chalcopyrite-outcroppings near the summit and down the mountain-side on the *Lucky Four No. 6* mineral claim, and located the site for a camp and for the portal of an adit about 1,200 feet below the summit. During the past summer a good log cabin was built and arrangements made to drive the adit during the present winter.

Geology.—The Cheam range of mountains belongs to the Coast mountains, and while the prevailing rock formation is granodiorite, there also occur on the *Lucky Four* and adjoining properties belts of metamorphosed argillites and schists which remained as roof-pendants after the intrusion of the batholith of granodiorite. At and near the contact of these altered sedimentaries and the granodiorite are found occurrences of copper ores. The granodiorite usually near the contacts has a gneissic structure and sometimes is quite schistose.

Instead of the geology in the Coast mountains in this vicinity being simple and merely represented by a great batholith of eruptive rocks, it is complicated in a very similar manner to which attention is called by Chas. Camsell in Summary Report, 1917, "Reconnaissance along the Pacific Great Eastern Railway, between Squamish and Lillooet," published by Canada Department of Mines.


DELTA FRC
FIRST DRILLSITE
Elev 6,000ft
N.W. Corner Lucky Four No 4
LUCKY FOUR No 3
North Boundary Lucky Four No 4
N 61° 03 W
West Bdy Lucky Four No 3
LUCKY FOUR GROUP
New Westminster M.D.
Plan of Diamond Drilling
Scale.
80 60 30 0 90 180 270 360 Feet
To accompany Report of W.M. Brewer, Resident Engineer, Nanaimo
1918
DRILL HOLE A. LENGTH Diagonal 1000 Horizontal 930 DIP 23°
LUCKY FOUR No 4 M.C.
LOT 989
SECOND DRILLSITE
Elev. 6,160ft
Hole No 4 dip 35° length 728 ; horiz. 61.3
Hole No 3 dip 45° length 716 ; horiz. 82.5
Hole No 2 dip 45° Length 728 ; horizontal 514
Hole No 1 dip 45° Length 727 ; horizontal 514
Hole No 5 dip 50° Length 1287 ; horizontal 827
Elevation of Hole A at crossing of No 4 Hole, 3835'
Elev 6069
Elev. 6078ft
Elev. 6044ft
Elev. 6044
Elev. 5398
Elev. 6,285ft
Elev. 5775ft. (bottom of hole)
CLIFF
Elev. 6,285
End of Hole A Elev. 5775
Section on A B
Scale
B.C. Bureau of Mines

Ore-deposits.—Copper ore, almost exclusively chalcopyrite, occurs on the *Lucky Four* group in a wide zone or stockwork of metamorphosed argillites in which occur many narrow quartz veins. The line of strike of this formation is N. 65° W. and dip nearly vertical, with high angle towards the north, so far as can be determined from the present condition of the prospecting-work that has been done. The stockwork is bounded on the northerly and southerly sides by granodiorite, which on the southerly side has a pronounced gneissic structure near the occurrence of ore. Apparently the metamorphosed argillites to a great extent form a capping covering bodies of solid ore.

This condition is shown on the southerly slope of the Cheam range at a point where an open-cut about 20 feet wide has been made on the edge of a precipitous cliff. The face of the open-cut is about 10 feet high, and a practically solid body of chalcopyrite ore is exposed, dipping almost vertical, with the hanging or northerly wall having been carried off by erosion and the apparent foot-wall made up of granodiorite with gneissic structure. The work has not determined whether or not the so-called foot-wall is a permanent wall or merely represents a horse or dyke intruded into the ore-bearing zone. A sample taken across the full width of the open-cut assayed: Gold, trace; silver, 2 oz.; copper, 7.6 per cent.

The stockwork of altered argillites impregnated with quartz veins has a very considerable length, and apparently extends across the summit of the range to the northerly slope, where it is generally hidden by glaciers. This fact is presumed from the results of diamond-drill borings into ore beneath the glacier.

The point where development-work is proposed to be done on the southerly slope of the mountain range is approximately 1,200 feet vertically below the summit of the outcroppings of the mineralized zone, and the results will determine to a very great extent the value of the property from a mining standpoint.

From such an examination of the surface as is possible under present conditions, the statement is warranted that the property bears all the indications of developing into one of the big copper-mines of the Province of British Columbia, and to rank with the Britannia and Anyox mines so far as quantity of ore is concerned, but promises to produce an ore of considerably higher grade than either of those.

In making his examination the writer was ably assisted by A. S. Williamson, the superintendent, who extended every courtesy possible, and to whom thanks and acknowledgment are due for plans of the property, as well as for photographs showing some of the difficulties that were experienced in transporting the diamond-drill outfit up the glacier.

Development-work.—The development-work comprises prospecting on the northerly slope of the Cheam range with diamond-drill; stripping and open-cut work on the southerly slope of the range; building cabin near that work; and constructing a pack-trail from the Canadian Northern Pacific Railway to the northerly summit, a distance of about fifteen miles. The proposed development-work will consist of cruising and constructing a pack-trail up Ford creek and Granite basin from the Chilliwack river to the camp, as well as driving a main adit across the ore-bearing zone near the head of Granite basin, with drifts and upraises to determine the extent of the deposits.

Mary Jane and Annie Lou

These mineral claims are located on Jones mountain, about two miles and a half south-easterly from Cheam View Station, on the Canadian Northern Pacific Railway, in the New Westminster Mining Division, British Columbia. The claims are staked adjoining each other up the mountain in an easterly direction, the *Mary Jane* being at the lower elevation, with the prospecting-work at about 700 feet above sea-level, and the *Annie Lou* at higher elevation, with the prospecting-work at about 900 feet elevation. The property is reached by a good trail which branches off from the Yale wagon-road at a point about a mile and a half from Cheam View Station, and is constructed up the mountain-slope to the outcroppings of quartz carrying molybdenite, where prospecting-work has been carried on. The *Mary Jane* mineral claim is owned by D. and Angus K. MacDonald, of Chilliwack, and the *Annie Lou* mineral claim by H. L. Larson, of Chilliwack.

Geography.—Jones mountain is a high peak in the Cheam range of mountains. That range forms the divide between the Fraser and Chilliwack rivers and extends from near Chilliwack to Silver creek, near the town of Hope. The mountain-slope on which the mineral claims are located overlooks the Fraser river and is very precipitous, having suffered greatly from erosion. The mountain-side is heavily timbered with cedar, hemlock, fir, and spruce, which is being logged off to supply the saw and shingle mills in the vicinity.

Geology.—The prevailing country-rock in the vicinity of the *Mary Jane* and *Annie Lou* mineral claims is granodiorite belonging to the Coast Range batholith, and on the claims there occurs a shear-zone in the granitic rocks of undetermined extent. The zone has suffered very greatly from erosion and shows very considerable fracturing, fissuring, and alteration, with some of the fissures filled with quartz carrying molybdenite ore.

Characteristics of Ore-bodies.—The occurrences of molybdenite occur on both the *Mary Jane* and the *Annie Lou* claims under the same structural conditions; that is, the molybdenite occurs in gash-veins filled with quartz, and apparently there are no other minerals associated with the molybdenite so far as can be determined by the naked eye.

The exposures so far discovered are lenticular, and the percentage of molybdenite disseminated through the quartz is very irregular. Sometimes lumps of considerable size of practically pure molybdenite occur in the quartz, and at other times the molybdenite is disseminated through portions of the quartz gangue as flakes.

The workings where the ore is exposed show clearly the lenticular structure of the quartz-filler in the fissures, so much so that in an adit on the *Mary Jane* claim, which has been driven about 20 feet along the strike of the quartz vein, the width of the vein varies from the thickness of a knife-blade to about 15 inches, and this variation is noticeable both along the dip as well as along the strike of the vein. In the open-cut approach to the adit the foot-wall has been stripped for a length of about 20 feet on the dip of the vein, which is 36 degrees towards the west. The top of this stripping shows the vein to be very narrow, and about 10 feet below the top of the stripping the vein has widened out to about 15 inches; then it narrows down gradually to a few inches, and appears to wedge out entirely a few feet below the floor of the adit.

On the *Annie Lou* claim the prospecting done has been all open-cut work. The stripping for the open-cut was commenced where the vein is very narrow, but about 10 feet from that point the quartz, carrying molybdenite, has a maximum width of about 3 feet. This body gradually narrows down to about 12 inches, which width is maintained for about 10 or 15 feet to the face of the open-cut.

In this open-cut some molybdenite ore occurs disseminated in the granitic foot-wall near the cleavage-planes of the shearing, but to what extent in width this occurs is undetermined. The open-cut referred to has a total length of about 50 feet, but of that 50 feet the ore only occurs for a total length of about 30 feet, or as two lenses. About 15 feet below the open-cut already described another cut has been made for a length of about 10 feet. The cut is in soil nearly to the face, where solid rock is exposed, carrying some molybdenite.

The erosion has been so great that the mountain-side below the open-cut where the ore is exposed has been carried away, so that when the dip, which is 36 degrees towards the west, is considered, there cannot be much chance for any ore to be found below the present exposures, at least for some considerable depth, because if the quartz veins have maintained continuity to depth previous to the erosion they have been carried away by that action. There is, though, a good chance to expose other lenses of quartz farther up the mountain-side, which rises to a very considerable elevation above the present workings.

Along the strike of the quartz veins it is possible that continuity may be maintained through a section of the country-rock that has not suffered from erosion, and it is also possible that in the mountain-slope, below where the erosion has taken place, similar vein-structure may be discovered.

Two samples were taken from the *Mary Jane* claim and two from the *Annie Lou*. One of these samples represents a section through the vein on the *Mary Jane* claim near the portal to the adit, chipped across 15 inches. The other samples all represent grab samples from the dumps, and are selected to represent such ore as was considered of shipping grade. It is hardly possible to determine offhand what proportion this selected ore represents with regard to the entire ore body. Samples taken assayed: Gold, trace; silver, trace; copper, trace; molybdenite, 2.5 per cent. Gold, trace; silver, trace; copper, trace; molybdenite, trace. Gold, trace; silver, trace; copper, trace; molybdenite, 0.2 per cent. Gold, trace; silver, trace; copper, trace; molybdenite, 0.6 per cent.

Stave River Section.

The area covered by the Stave River section of the New Westminster Mining Division lies between the Harrison lake on the east and Pitt lake and river on the west, and is drained by the Stave lake, the main Stave river, upper Stave river, and several tributaries, all of which, except

the lake, are torrential streams which rise in steep mountains where there are several glaciers and ice-fields, so that a good deal of difficulty is encountered by prospectors in exploring the section. To a great extent these conditions account for the fact that the section has been so little prospected, and that the discovery of any occurrences of minerals so far reported has been the result of work by trappers and hunters rather than the systematic work of prospectors. Up to the present time the only minerals reported as occurring in the section are molybdenite and copper-sulphide ores.

The lack of transportation facilities will prove a handicap that will interfere seriously with carrying on mining-development work at the present time, but should prospecting result in the discovery of deposits of minerals of commercial value, there does not appear to be any very serious difficulties to contend with in constructing necessary roads and trails.

Stave River Group.

This group of mineral claims was examined on June 30th, 1918, and it is possible that a mine of commercial importance may be developed here, provided the vein material, which carries molybdenite, is concentrated on the ground. The extent of this material is apparently so great and the structure of the occurrence of the deposit of such character that mining operations can be carried on by quarrying, and possibly after further prospecting it will be determined that a steam-shovel could be operated to advantage. While the assay results from the samples taken by the writer do not show a high percentage of molybdenite, it is quite possible that this feature may be overcome by the low cost at which mining, concentration, and transportation can be carried on.

Penstock creek, which flows near the deposit, carries quite a considerable volume of water over a series of falls where the water at one point drops about 200 feet vertically in about 600 feet horizontal distance, and there is a natural penstock at the lower end, so that a water-power can be developed at minimum cost for installation.

Geography.—The *Stave River* group of mineral claims is located in the New Westminster Mining Division, near the upper Stave river, at an elevation of about 2,500 feet above sea-level and about six miles in a north-westerly direction from the head of Stave lake, which empties into Stave river, a tributary of the Fraser river, into which it flows near Ruskin Station, on the Canadian Pacific Railway, about thirty-five miles east of Vancouver.

There are two routes by which the group of mineral claims can be approached. The first is that followed by the writer in company with Moses and Dave Bouchir, of Hatzic Prairie, who own the property. By this route an automobile was taken from Mission Station to within three miles of an old shingle-bolt camp on McConnell creek, which empties into Stave lake near the outlet. After walking the three miles the journey was continued in a gasolene-launch down McConnell creek to its confluence with Stave lake, a distance of about two miles; thence up the lake about ten miles to a point about a mile and a half above the mouth of the upper Stave river, from which point an old logging-trail was followed on the east side of the river for about six miles to the property. The other route is to take the railway of the Canada West Power Company from Ruskin Station, on the Canadian Pacific Railway, to the power-house above the Stave River falls, and a boat from there up the lake to the end of the trail on the upper Stave river.

Geology.—The prevailing country-rock in the vicinity of the property is granitic, which shows the effects of shearing and much of it has a banded or gneissic structure. Wide fissures are noticeable in the granitic rock. The most prominent of these is filled with quartzose rock, in which occur disseminations of particles of molybdenite of varying sizes, from merely flakes to pieces of solid molybdenite about 2 inches square by ½ inch thick.

Ore-deposits.—The occurrence of molybdenite ore in the district was first noted by hunters while climbing over an immense rock-slide, which extends from near the top of the mountain in which the ledge of quartzose rock occurs that has been already mentioned to near the upper Stave river. Mixed with boulders and debris in the rock-slide are very many pieces of rock which contained flakes and lumps of molybdenite. This float was traced up the slide to the ledge from which it had broken away, and the claims were staked in consequence. The molybdenite ore occurs disseminated irregularly through the quartzose gangue material for a very considerable distance along the apparent strike.

At one point the width of ledge-matter is nearly 75 feet, and the narrowest part of the mineralized ledge observed by the writer is about 15 feet. The strike is north-westerly, so far

Hauling Diamond-drill up Glacier, Lucky Four Group, New Westminster M.D.

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as can be determined at the present time, and the dip is at a high angle towards the south-west, but development-work may determine that the strike and dip vary from the direction and angle given.

It is very difficult at present to estimate the proportion of mineralized quartzose rock in the ledge, because no cuts have been made into the vein material. The present appearance is that of a high, bare rocky wall with precipitous face, in which the lumps of molybdenite occur, resembling very much the appearance of currants in a loaf of cake.

Assays.—A grab sample taken from where the mineralized ledge-matter is about 75 feet wide assayed: Gold, trace; silver, trace; copper, trace; molybdenite, 0.78 per cent.

A sample of the quartzose gangue taken from close to the hanging-wall granite assayed: Gold, trace; silver, trace; copper, trace; molybdenite, trace.

A grab sample taken from the ledge at a point about 500 feet south-westerly from where the first-mentioned sample was taken assayed: Gold, trace; silver, 0.4 oz.; copper, 0.3 per cent.; molybdenite, 1.5 per cent.

A selected sample taken from the big slide assayed: Gold, trace; silver, trace; copper, trace; molybdenite, 2 per cent.

Another selected sample taken from the big slide assayed: Gold, trace; silver, trace; copper, trace; molybdenite, 1.3 per cent.

Agassiz Section.

The Agassiz section of the New Westminster Mining Division covers the area from the westerly side of Harrison lake to the easterly boundary of the Mining Division. In this section the Fraser valley is bounded on the north by a range of precipitous mountains, in parts of which the rock formation is made up of metamorphosed limestone and igneous rock resembling greenstone. The occurrence of copper-sulphide ore is the mineralization most usually found, and the deposits belong to the contact-metamorphic type, but there are also some occurrences of molybdenite on a mountain known as "Hurling's," about seven miles easterly from the town of Agassiz.

The Agassiz section has not been prospected with any degree of thoroughness beyond a comparatively short distance from the line of the Canadian Pacific Railway, which part of the section was examined by the writer in October, 1918.

Last Chance Group.

This group of mineral claims contains six claims, known as *Last Chance*, *Copper Duke*, *Lone Star*, *Copper Galore*, *Acorn*, and *Copper King*. The group of claims is located one claim wide from the foot of Hurling's mountain in a northerly direction up the side of the mountain over the summit. Hurling's mountain is about seven miles easterly from the town of Agassiz, on the Canadian Pacific Railway. The group is owned by W. Hicks, of Ruby Creek Post-office, and several associates.

Geology.—The prevailing rock formation is metamorphosed limestone, with which is associated an igneous rock very much sheared and sometimes with schistose structure. These rocks appear to form a contact-metamorphosed zone of undetermined extent. The mountain-side is very steep and the effects of erosion quite pronounced.

Characteristics of Ore-deposits.—In the cleavage-planes chiefly, but also sometimes disseminated through the metamorphosed rock, there occurs some mineralization, principally made up of iron pyrite, with flakes and sometimes lumps of molybdenite associated with the pyrite, also some chalcopyrite. The occurrence of the mineralization is quite irregular, so far as can be seen from the limited amount of work done. The chief showing of mineral is at an elevation of about 1,200 feet above sea-level on the *Last Chance* claim, about a mile and a half from the railway-track. There are also outcroppings on the *Lone Star*, *Copper Duke*, and *Copper Galore* claims, the last mentioned occurring at an elevation about 500 feet higher than those on the *Last Chance* claim. The samples taken were assayed for nickel, because one of the owners stated that an assayer had claimed he found nickel in the ore. Samples taken from several of the outcroppings assayed:—

No. 1: Nickel, *nil;* gold, trace; silver, 0.2 oz.; copper, 0.3 per cent.; molybdenite, trace.
No. 2: Nickel, *nil;* gold, trace; silver, trace; copper, *nil;* molybdenite, trace.
No. 3: Nickel, *nil;* gold, trace; silver, trace; copper, *nil;* molybdenite, trace.
No. 4: Nickel, *nil;* gold, trace; silver, trace; copper, *nil;* molybdenite, trace.
No. 5: Nickel, *nil;* gold, trace; silver, trace; copper, *nil;* molybdenite, 4.2 per cent.

Development-work.—The development-work consists of several open-cuts and prospect-pits, representing assessment-work to hold the mineral claims.

Contact Group. This group of mineral claims consists of several mineral claims which have been grouped for the purpose of doing all of the development-work on one claim. The group is located on the southerly side of the mountain north of the Canadian Pacific Railway track, about five miles east of the town of Agassiz, at an elevation of about 500 feet above the Fraser river. The property is held under lease by John McConville, of Vancouver, who is developing and operating on a royalty basis.

Geology.—The prevailing country-rock on the *Contact* group is crystalline limestone, which contacts with granodiorite near the western boundary of the claim on which the work is being done.

Characteristics of Ore-deposits.—The mineralization is made up of gossan, in which occur bodies of considerable size of copper carbonate and chalcopyrite of higher grade than is usually found. The gangue is made up of altered limestone, epidote, and garnetite. The ore occurs as lenses and the deposits belong to the contact-metamorphic type, although the occurrences of ore are not at the actual contact between the granodiorite and limestone.

The main outcroppings of gossan and chalcopyrite occur as a blanket, covering limestone and garnetite for a length of about 50 feet and a width of about 20 feet on an incline of 50 degrees. It appears as though the limestone forms the foot-wall of the deposit, the hanging-wall having been carried off by erosion. The thickness of ore varies from a few inches to possibly 3 feet, but when the examination was made the work had not progressed far enough to determine the maximum thickness of the outcroppings, nor whether at any point the ore occurred in a fissure in the limestone, which is possible because there is considerable shearing movement apparent.

At another point a short distance in a westerly direction and about 50 feet lower elevation there are outcroppings of copper carbonates and chalcopyrite in gossan, which apparently fill a narrow fissure in the limestone. The maximum width so far shown is about 3 feet, but the width varies considerably in a length of 18 feet, which is the maximum length determined at the time of the examination.

Samples taken from the ore exposed in the workings, assayed: No. 1: Gold, trace; silver, 4 oz.; copper, 19 per cent. No. 2: Gold, trace; silver, 4 oz.; copper, 10.2 per cent.

Development-work.—The development-work consists of open-cuts and stripping on the first-mentioned outcropping, and open-cuts and a shallow shaft on the second-mentioned outcropping. There is also an adit on the last-mentioned deposit, which is driven on the westerly side of the open-cut 25 feet long in a northerly direction.

A sleigh road is constructed about a quarter of a mile long to connect the mine-workings with the wagon-road from the *Empress* group of mineral claims, located on the same mountain, to the main road to Agassiz Station.

Empress Group. This group of mineral claims from which ore was shipped to smelter during a portion of 1917 has not been in operation during the past year. The group is owned by the estate of the late Barclay Bonthrone, who was killed in an auto accident several months since.

VANCOUVER MINING DIVISION.

The Vancouver Mining Division occupies an area on the Mainland, as well as several small islands directly tributary to the city of Vancouver. The northern boundary follows the Coast range from north of the head of Jervis inlet south-easterly to Green lake, near Mons Station, on the Pacific Great Eastern Railway; the eastern boundary adjoins the western boundary of the New Westminster Mining Division and generally follows an irregular line southerly from Green lake to the head of Burrard inlet; the southern boundary is the North arm of the Fraser river and the coast-line of the Strait of Georgia to Point Grey, and thence to the west side of Jervis inlet, a distance of about thirty-five miles from Vancouver City; and the western boundary follows the watershed between Jervis inlet and Powell lake.

So far as metalliferous lode-mining is concerned, the Vancouver Mining Division is by far the most important Division in the Western Mineral Survey District, by reason of the fact that the *Britannia* mine is within its boundaries, and the further fact that its distributing centre is the largest city in the Province, which naturally attracts many mining men, as well as brokers and some prospectors.

For convenience the Division has been subdivided in this report into three sections, as follows: Britannia Belt, Pacific Great Eastern Railway, and Lynn Creek.

Britannia Belt Section.

The geologic formation locally known as the "Britannia belt" occurs as bands of metamorphosed sedimentary rocks which were not destroyed by the intrusion of the granodiorite, and the strike of which conforms generally with the direction of the axis of the Coast range of mountains. The Britannia belt reaches its maximum extent in width in the high mountains in which Britannia, Mineral, and Furry creeks rise, about three miles easterly from Britannia Beach, on Howe sound. The full length of the belt is as yet undetermined, but apparently it extends about twelve miles easterly from Howe sound and as far as the easterly side of the headwaters of the Indian river, which flows into the head of the North arm of Burrard inlet.

Britannia Mining and Smelting Co., Ltd.—During 1918 the Britannia Mining and Smelting Company, in addition to carrying on operations in the developed and productive mines owned by the company, has paid considerable attention to examinations of several prospects to the eastward of the centre of the activity around the *Fairview*, *Empress*, *Bluff*, and *Jane* mines. Several of the prospects which have been practically idle for some years back were acquired by the Britannia Company, so that at the present time that company controls the Britannia geologic belt for a length of about twelve miles and an average width of several hundred feet. The company has expended, according to the statement of J. W. D. Moodie, the general manager, nearly $1,500,000 in acquiring properties outside of the original group of mineral claims which comprised its holdings up to about six years ago. This policy has been of great assistance to the prospector and small mine-owner who had mineral claims located in the mountains, which were inaccessible because of lack of transportation facilities and lack of capital by the owners of the claims to install such.

Britannia.

The operations of the Britannia Mining Company are, of course, far more important than those of any other company in the Western Mineral Survey District, and for that reason the following description of the development-work and improvements that have been carried on during 1918 are given in more detail in this report. The following shows the development-work performed in the mine: Drifts, 9,837 feet; crosscuts, 4,427 feet; raises, 8,754 feet; chutes, 1,541 feet; winzes, 36 feet; total, 24,595 feet.

Development-work.—In the *Fairview* mine drifts have been extended on previously developed veins, also new ones have been opened up to the south, on which stoping operations have started. The outside glory-holes were worked during the open season (seven months), breaking ore on top of the mountain into large transfer rock-chutes, delivering it to the underground crushers with but one handling.

The *Bluff* mine to the west and the *Empress* mine to the east of *Fairview* have been extensively developed during the year and stoping has been started. Two drifts are being driven west under the *Jane* mine on the 1,200-foot level, developing this ore-body 200 feet below any previous working-level.

During the year another connection through Britannia mountain was made, this being on the 600-foot level, making the fourth level to have portals on both the north and south side of the mountain. Two other levels, the 1,200- and 1,600-foot, are being driven through for connection, the former having approximately 1,600 feet to go and the latter 700 feet.

Work is progressing for the extension of No. 1 shaft from the 1,000-foot level to the 700-foot level, and also the extension of the Grandview shaft (No. 3 shaft) from the 500-foot to the 700-foot level. This construction will in time supplement the No. 2 shaft, now operating between the 1,000-foot and 500-foot levels.

A crosscut adit, 8 x 8 feet, known as the Victoria tunnel, to the east of the present *Empress* workings, at the elevation of the 1,800-foot level, has been advanced 400 feet to prospect the extension of the veins in that section of the property. Another crosscut, 8 x 8 feet, known as the Hillside tunnel, is being driven at a point west of the present *Jane* mine at the elevation of the 1,000-foot level. This has advanced approximately 200 feet.

Considerable diamond-drilling has been done during the year, prospecting new areas and also to prove the extension of known ore-bodies. The footages driven in the different mines are as follows: *Fairview*, 15,062 feet; *Empress*, 4,897 feet; *Bluff*, 2,404 feet; *Jane*, 2,071 feet; 3,100-foot tunnel, 690 feet; 2,700-foot tunnel, 1,558 feet; total, 26,682 feet.

The 4,100-foot level tunnel, the portal of which is about the level of the roof of the mill, was advanced 1,735 feet during the year, making the total length 4,220 feet. This tunnel will eventually be used as the main haulage adit. A raise has been started at this level and driven a distance of 100 feet. This raise will be continued to the 3,100-foot level, a distance of 1,130 feet, and from there to the 2,700-foot level, 370 feet. This raise is 7 x 12 feet and is being driven on a 65-degree slope.

The 3,100-foot level east drift was advanced 659 feet, and from this drift another drift 260 feet long has been driven to the location of the proposed raise from the 4,100-foot level, from which point it is proposed to raise to the Armour crosscut, 2,700-foot level, at the westerly end of the tunnel railway. The Armour crosscut has been driven a distance of 502 feet.

The raise from the 4,100-foot level to the 2,700-foot level will be used to transfer the mine ore to the 4,100-foot level, and thence a distance of about 5,000 feet by railway to the mill.

The 2,200 Daisy tunnel was advanced 910 feet, making the total length 1,309 feet, and a crosscut 106 feet long driven to the south.

The Harp tunnel was advanced 811 feet to completion during the year. This tunnel is 2,246 feet long and will be used to divert water for power purposes.

The following tunnels driven for development-work were advanced during the year: Lantz tunnel, advance for year, 60 feet; footage to date, 890 feet. Lloyd tunnel, advance for year, 71 feet; footage to date, 134 feet. Copper Mountain tunnel, advance for year, 152 feet; footage to date, 324 feet.

Equipment.—Four Westinghouse 3½-ton storage-battery mine locomotives were added to the previous equipment of eight, in addition to which there are in the mine one 6-ton General Electric trolly locomotive and two 3½-ton Westinghouse trolly locomotives.

Fifty-four 2-ton automatic side-dump cars were added to the mine equipment, making a total of approximately 150 cars of this type. Besides these, twenty cars of the same type and size, but built for a 3-foot gauge, were added to the equipment for handling ore broken on the 2,200-foot level and for outside tunnels having a 3-foot gauge.

The present equipment of the tunnel railway consists of ten 20-ton bottom-dump cars; twelve 20-ton side-dump cars; two flat cars; four 15-ton electric locomotives; one 8-ton electric locomotive; and one 40-ton electric locomotive. The 40-ton locomotive was added during the year.

The present equipment of machine-drill sharpeners, including those located at outside tunnels, as well as at the mine proper, consists of nine Leyner machines, four Sullivan, and one Waugh. A 3,600-cubic-foot-per-minute compressor, driven by a 600-horse-power output motor, was installed in the Beach power-house.

No new buildings were erected at the mine, with the exception of a concrete storage or root house; outside dimensions 38 x 30 feet, with an inside height of 9 feet at the crown of the arched roof. This is located at the tunnel cook-house and affords an excellent place for the storage of winter vegetables.

Attorney Group. This group contains fourteen mineral claims, named as follows: *Covenanter, Alastor, Attorney No. 6, Missing Link, Attorney No. 5, Attorney No. 4, Attorney No. 3, Attorney No. 2, Attorney No. 1, O.K., Canyon, Wedge Fraction, Orator, Imperator.* The group is located in the mountains adjacent to Alberta bay, Howe sound, about half-way between Point Atkinson and Britannia Beach, and is reached by a trail from Alberta bay. The property is owned by the Attorney Copper Gold Syndicate, of Vancouver, of which Wm. Savage is trustee and J. C. Fisher is superintendent.

Owing to the fact that this property was only brought to the attention of the writer too late in 1918 for an examination to be made, no report is made of it, but it will be examined at the earliest opportunity in 1919.

Bowena Group. This group, which contains three Crown-granted mineral claims—*Emerald, Emerald No. 1,* and *Bowena No. 1*—is located on the east side of Bowen island, a short distance southerly from Snug cove, where one of the vessels owned by the Terminal Steam Navigation Company, Limited, calls daily en route to Squamish. The property is owned by the Bowena Copper Mines, Limited, 417 Rogers Building, Vancouver, but is at present under lease to Clarence W. Tipping, of Bowen island, who is preparing to install a concentrating plant in the near future and to extend the development-work. The writer has arranged to examine the property after the installation of the plant, when it is being actively operated.

Lynn Creek Section.

The Lynn Creek section of the Vancouver Mining Division comprises that portion of the Division which includes the mountains in the vicinity of Lynn creek and North Vancouver. Until 1918 this section has received very little attention for several years past, but interest was revived in the spring of 1918 by the operations of W. F. Dunphy, who bonded several groups of mineral claims on which copper-sulphide ore occurs, and also because of rumours that the work on the group of mineral claims at the head of Lynn creek, on which ore occurs carrying values principally in zinc, was to be reopened.

So far as the last-mentioned rumours are concerned, they proved to be groundless and no operations were carried on at the so-called zinc-mines. The property of the Lynn Creek Zinc Mines, Limited, was fully described in the Report of the Minister of Mines for 1917, on page 280; consequently it is unnecessary to repeat the description in the present report.

Mountain Lion Group.

This group of mineral claims, on the east side of Lynn creek, near North Vancouver, was operated during a part of the past year by W. F. Dunphy under bond from the Lynn Valley Copper Gold Mining Company, Limited. The old workings were reopened and some addditional development-work was done. It was proposed to ship the ore on the old dumps via an automobile-road constructed up the creek from the intake by the Cotton Contracting Company, of Vancouver, for the Cedars Company, Limited, which built a sawmill about a mile and a quarter above the intake and about a mile below the *Mountain Lion* group.

Mr. Dunphy also bonded the Crown-granted mineral claims owned by the Lynn Creek Gold-Copper Mining Company, Limited, which are situated on the west side of Lynn creek, and he proposed working this group in connection with the *Mountain Lion* group. Ore-bins and a camp were constructed at the last-named property, to which the auto-road is to be built. The ore on the dumps at the *Mountain Lion* is chiefly chalcopyrite in a gangue made up of epidote, garnet, and hornblende. Grab samples assayed from 3.8 per cent. up to 16.4 per cent. in copper, with traces in gold and about 2 oz. in silver. Operations were discontinued during the summer, when Mr. Dunphy met with a serious automobile accident, and have not been since resumed.

Pacific Great Eastern Railway Section.

The Pacific Great Eastern section of the Vancouver Mining Division is so named because the mineral claims examined are tributary to that line of railway, and are situated in the mountains adjacent to the headwaters of the Cheakamus river and the chain of lakes on the divide between the Cheakamus and Green rivers, which is the boundary between the Vancouver and Lillooet Mining Divisions.

This section was examined by Chas. Camsell for the Canada Geological Survey in 1917, and is referred to in his Summary Report for that year. He draws especial attention to the rather complicated geologic conditions and to the bands of metamorphosed sedimentary rocks which occur as roof-pendants in the intrusive granodiorite batholith.

The section was examined by the writer during the latter part of September, 1918, when his attention was attracted by the conditions referred to by Mr. Camsell and to the opportunities that presented themselves for thoroughly prospecting the neighbourhood, which until the railway was completed was badly handicapped by lack of transportation facilities.

Fitzsimmons Group.

This group contains five full-sized mineral claims and one fractional claim, all of which are Crown-granted. The claims are named as follows: *Yellow Jacket*, *Blue Jacket*, *Last Chance*, *Sunrise*, *All Up*, and *Leona Fraction*. The group was staked in 1901 and Crown-granted in 1911. In 1918 the property was bonded to the Consolidated Mining, Smelting, and Power Company, of Trail, on the recommendation of M. E. Purcell, one of that Company's mining engineers. The group is located about three miles from the railway-track, but about four miles from Mons Station and about forty miles from Squamish, the ocean terminal of the railway. The property is reached by a good pack-trail from the railway. Fitzsimmons creek, which empties into Green lake, flows across the southerly end of the *Last Chance* claim, which is the most southerly one of the group.

Geology.—The country-rock on the *Fitzsimmons* group is chiefly metamorphosed sedimentary rock, including limestone, very much altered, fractured, sheared, and fissured, and intruded by a number of narrow porphyry dykes. The extent of the band of altered sedimentaries has not been determined.

Characteristics of the Ore-deposits.—The most prominent occurrence of ore on the *Fitzsimmons* group is on the *Yellow Jacket* mineral claim near the north-east corner, where a face of mineralized rock occurs in a high bluff made up of contact-metamorphic rocks. The mineralization is an association of copper carbonates, with some chalcopyrite and iron pyrite. An open-cut has been made about 50 feet long, along the strike of the ore in a south-easterly direction, and about 40 feet wide across the ore-body, which dips nearly vertical. A sample from this exposure assayed: Gold, trace; silver, trace; copper, 2.5 per cent. Another exposure of low-grade ore occurs on the *Sunrise* mineral claim at a point about 400 feet in a south-easterly direction from the open-cut on the *Yellow Jacket*, where along the top of a ridge there are three smaller open-cuts in which ore is exposed containing a small quantity of galena associated with zinc-blende, chalcopyrite, and iron pyrite in a quartzose gangue in which there is considerable epidote. A sample from these open-cuts assayed: Gold, trace; silver, trace; copper, 1.2 per cent.

Cougar Group.

This group contains eight Crown-granted mineral claims and a fractional claim, known as: *Good Luck*, Land Lot No. 3405; *Summit*, Land Lot No. 3404; *Morning Star*, Land Lot No. 3403; *Iron King*, Land Lot No. 3402; *Iron King No. 2 Fraction; Vulcan No. 2*, Land Lot No. 3411; *Vulcan*, Land Lot No. 3406; *Empress*, Land Lot No. 3407; *Cougar*, Land Lot No. 3408. The group is located near the north end of Alta lake, about two miles northerly from Mons Station, on the Pacific Great Eastern Railway, and about forty miles from the terminus at Squamish. The property is held under bond by Dr. Davidson and associates, of Vancouver, from the owners F. S. Keith, J. H. Thompson, and C. Wilber Smith, of Vancouver.

Geology.—Chas. Camsell, of the Canadian Geological Survey, in his Summary Report for 1917 refers to the geologic formation in the vicinity of the *Cougar* group as a part of the Mons band of stratified rocks of the Jura-Triassic age, which probably at one time covered all of the region between Anderson lake, in the Lillooet Mining Division, and Howe sound, on the Coast. At present, however, owing to intrusion of the Coast batholith and subsequent erosion, only a few isolated bands of these stratified rocks remain, one of which is traversed by that part of the Pacific Great Eastern Railway in which the *Cougar* group is located, and is designated by Camsell as the Mons band, which is traversed by the railway from the Cheakamus river to Green lake.

Characteristics of Ore-deposits.—The principal exposure of limonite ore occurs about half a mile west from the north end of Alta lake and outcrops on the westerly edge of a large swamp at the foot of a thickly wooded hillside. Starting from this point and following a general north-westerly direction up the hill, several outcroppings occur within an area of about 450 feet in length and about 250 feet in width. The extent of the deposits has not been fully determined, but the ore is exposed in several open-cuts within the area mentioned.

The surface outcroppings are usually loose and earthy, but a few feet below the ore is more compact and solid. Apparently the ore is underlaid with bluish clay in places, which shows stratification. To the westerly from the outcroppings of limonite the mountain rises abruptly to a very considerable height. The rock formation is schistose in structure and carries a high percentage of iron pyrites, from the oxidation of which apparently the limonite derives its origin.

Development-work.—The development-work on the *Cougar* group of mineral claims consists of several open-cuts varying in extent from about 39 feet long, 12 feet deep, by 8 feet wide to a prospect-hole 4 feet long, 4 feet deep, by 4 feet wide. These show the ore to vary from about 1 foot to 12 feet in thickness, but the work has not been done so as to determine the extent.

A steam-shovel and equipment was installed in September last and a spur track built to connect the mine-workings with the Pacific Great Eastern Railway, about half a mile northerly from the Rainbow Lodge flag-station.

Samples and Assays.—Samples were taken from five exposures of limonite ore in open-cuts. These assayed:—

	Iron.	Phosphorus.	Sulphur.	Silica.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
From open-cut near north-easterly boundary of ore-zone	51.8	2.9	1.19	4.2
From open-cut near south-westerly boundary of ore-zone	43.4	2.2	0.94	4.0
From open-cut on Iron King Fraction claim up hill from above samples	43.0	3.3	1.3	1.3
From solid ore in largest open-cut on Iron King Fraction	50.0	0.5	0.89	1.9
From open-cut on Morning Star mineral claim	26.5	2.5	0.76	39.5

Available Ore.—The work has not been done in a method such as permits of a reliable estimate being formed of the available tonnage of ore in the deposits. In addition to the area mentioned as being covered by the limonite ore, of about 450 x 250 feet, there are several outcroppings of this ore farther up the hillside which apparently represent isolated occurrences and on which but very little work has been done, so that it is not possible to estimate any tonnage.

With regard to the main deposit, Charles Camsell in his report estimates about 12,000 tons of ore in that deposit, but since he made his examination the development-work has been carried farther, so that at the time the writer made his examination the indications pointed to the probability that Mr. Camsell's estimate is too low.

The occurrences of the ore are, however, so erratic in structure that it is not safe to form an estimate. In considering tonnage of limonite ore in-place in the Southern States, the experienced ironmen will never commit themselves, and the same rule should be applied to the ore occurrences which are the subject of this report.

Callander.

This mineral claim is on Sproat mountain, about three miles by trail westerly from Mons Station, on the Pacific Great Eastern Railway, and is reached by travelling for about half a mile along the old tote-road, which at this point nearly parallels the railway-track; then taking a mountain trail toward the west which crosses a part of a group of twenty-two claims owned by McGilvray & McDonald, on which several adits have been driven in the schistose country-rock, apparently with a view of exposing ore-bodies at depth, which are indicated by outcroppings of mineralized rock in which occur stains from copper carbonates and a little chalcopyrite in a quartz gangue. After leaving the McGilvray & McDonald claims, the trail continues up the mountain-slope to near the summit of Sproat mountain, some distance above timber-line and to an elevation of nearly 6,000 feet above sea-level. The claim is owned by Horstman & Archibald, Alta Lake, B.C.

Geology.—The rock on Sproat mountain consists of interbedded slates, limestones, and some volcanic rocks cut by intrusive dykes of granodiorite. The limestone often occurs as lenses of various dimensions and altered to garnetite, epidote, and other contact-metamorphic minerals. The general line of strike of the altered limestone is north-westerly and dip almost vertical, with the incline, if any, toward the southerly. Shearing movement has been very pronounced, many of the rocks having a schistose structure with considerable talcose material in the cleavage-planes. Slickensides occur frequently, especially in the neighbourhood of ore-bodies, where movement has been the most pronounced.

Characteristics of the Ore-deposits.—Occurrences of copper and iron minerals are found on the *Callander* claim in a ridge near the summit of Sproat mountain and a short distance north of Sproat creek. The ridge is made up of altered limestone that has been intruded by an igneous dyke, and at and near the contact between these rocks there occur outcroppings of gossan of varying extent, in which is found chalcopyrite, iron pyrite, magnetite, and apparently a little arsenopyrite. These bodies of ore are enclosed by walls of granodiorite.

The ore-bodies have been opened up by the annual assessment-work and partially developed by open-cuts and one adit about 22 feet long. A sample taken from the workings assayed: Gold, trace; silver, 2.2 oz.; copper, 4.3 per cent.

Blue Grouse Group.

This group contains two mineral claims—*Blue Grouse* and *Nita*—and is located on Sproat mountain at an elevation of about 3,600 feet above the track of the Pacific Great Eastern Railway, and is reached by a branch trail in a south-westerly direction from McGilvray & McDonald's camp, about a mile and a half westerly from Mons Station, on the Pacific Great Eastern Railway. The group is owned by H. J. Blurton, of Mons, B.C.

Geology.—The rocks in the vicinity of this group of claims are mostly granitic, with gneissic structure, which contact with altered limestones and interbedded slates. All of these rocks are very much sheared and fractured.

Characteristics of the Ore-deposits.—Occurrences of copper and iron minerals occur in deposits of the contact-metamorphic type, which up to the time of examination had not been sufficiently developed for an unqualified opinion to be formed as to the future possibilities of the property. Ore is exposed in some shallow open-cuts, a sample of which assayed: Gold, trace; silver, trace; copper, 1.6 per cent.

King Solomon Group.

This group contains four mineral claims—*King Solomon*, *Hidden Treasure*, *Maple Leaf*, and *Lucky John*—and is located in a pass between the head of Fitzsimmons creek and Cheakamus lake, about eleven miles from Alta Lake Station, on the Pacific Great Eastern Railway. The property is reached by a poor trail from the easterly side of Alta lake. There is some question as to whether this property is in the Vancouver or Lillooet Mining Division. The group is owned by J. Findlay, J. Wilson, J. Bailiff, and L. M. Wilson, of Alta Lake, B.C.

Owing to the lateness of the season and a heavy storm prevailing on the day the writer proposed visiting the *King Solomon* group on September 30th, 1918, no examination was made, but in the Summary Report for 1917, Part B, Canada Department of Mines, the group is referred to in the notes made by George Hanson, assistant to Charles Camsell, geologist in charge, as follows:—

"The *King Solomon* group is situated at the head of Fitzsimmons creek, on the divide overlooking Cheakamus lake. A tunnel 45 feet in length has been driven to cut a bed of argillaceous limestone, mineralized by pyrite and magnetite, which outcrops on the hillside above and in which an open-cut has been made about 85 feet higher up. The limestone is in contact with sheared granodiorite near by, which is probably the cause of mineralization. The values are in gold, but are apparently low for that location."

Other Claims.—There are quite a large number of mineral claims located along Fitzsimmons creek and in the mountains adjacent which belong in the Lillooet Mining Division, but very near the dividing line, which have been partly developed by the owners doing the necessary annual assessment-work, but until the Pacific Great Eastern Railway was in operation this section of country was badly handicapped through lack of transportation facilities, and consequent difficulty in obtaining capital for development purposes.

At the end of September, 1918, the owners of practically all of the mineral claims were absent from the district, many of them being on service overseas; consequently it was not possible to make examinations, chiefly because of not being able to secure guides acquainted with the locations and position of the workings.

Prospecting for Oil.

During 1918 there has been more drilling done in prospecting for oil in the Fraser River delta than has been in the past, but so far no commercial results have been obtained. The most recent work is being carried on by the Spartan Oil Company, Limited, near Still creek, which flows from Burnaby lake. A diamond-drill is being used for boring, and at the end of 1918 a depth of about 1,100 feet had been reached and the drill was in shale. The prospects of finding oil in this district are discussed by Chas. Camsell in the Summary Report of the Geological Survey for 1918, page 22B.

VICTORIA MINING DIVISION.

For convenience the Victoria Mining Division has been subdivided into the following named sections: Cowichan Lake, East Sooke, Jordan River, and Saltspring Island.

Cowichan Lake Section.

The Cowichan Lake section of the Victoria Mining Division includes that part of the Division lying in the vicinity of the lake extending in a north-westerly direction from near Sahtlam Station, on the Cowichan Lake branch of the Esquimalt & Nanaimo Railway, to the Nitinat river, or about ten miles westerly from the head of Cowichan lake. This section is traversed by the grade of the Canadian Northern Pacific Railway, which, when steel is laid, will afford additional transportation facilities and help to develop the region between Cowichan lake and Alberni canal, in which there occur deposits of copper and galena ores that have never been developed.

One of the important developments during 1918 was the discovery of deposits of manganese ore near Cowichan lake, which promises to open up a new industry in British Columbia.

Hill 60 Group.

This group of mineral claims contains the *Hill 60*, *Hill 60 No. 2*, and *Hill 60 No. 3*, which were staked during the summer of 1918. The group is located near the summit of a mountain about 2,000 feet above sea-level and about five miles easterly from the foot of Cowichan lake. The location is about four miles by trail from the Cowichan Lake branch of the Esquimalt & Nanaimo Railway. It is reached by following a

Coal Prospect No. 1, Tsaabl River.

Outcrop of Manganese Ore, "Hill 60," Victoria M.D.

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trail from the Cowichan-Duncan wagon-road which branches off from the road about fifteen miles from the town of Duncan, near Sahtlam Station. The property is owned by C. H. Dickie and T. A. Wood, of Duncan; T. W. Service and M. L. Douglas, of Riverside, Cowichan Lake.

Geology.—The deposits of manganese ores occur in a belt of cherty jasperized rock which is said to be continuous from Mount Sicker to the northerly end of Cowichan lake, a distance of some forty miles, and is included in the Mount Sicker series of rock formation.

Characteristics of Ore-deposits.—Sufficient work has not yet been done to determine whether the deposits of manganese ore are residual or whether they occur as replacement deposits in the jasperized rock and occupy fissures in the sheared portion of the belt of rocks. The latter theory would appear, from the conditions at present shown by the shallow work that has been done, to be the more tenable, and if such prove to be the case it is reasonable to presume that the ore-deposits may possibly maintain continuity to some considerable depth, as the shearing movement appears to be widespread and deep-seated.

Development-work.—Up to the present time the development-work has been confined to the *Hill 60 No. 2* claim and consists of surface-stripping and open-cut work. At one point a short distance north-westerly from the No. 1 post on *Hill 60 No. 2* claim the outcropping has been stripped for a distance of 55 feet and an average horizontal width of 15 feet, but over 20 feet on the incline and to a depth of about 14 feet. Other open-cuts have been made both easterly and westerly from the main work, which demonstrates that the probable length of the deposit at this particular point is about 100 feet and the width about 15 feet.

In addition to this work there has been some prospecting done at a point about 250 feet lower level than the surface outcroppings and about 1,300 feet north-westerly from the main workings, but there is no actual evidence of any connection between the outcroppings exposed by the stripping and the last outcropping mentioned. The exact line of strike is quite difficult to determine, but it appears to be about N. 67° E., with a dip on the hanging-wall side of 70 degrees to the south.

Samples and Assays.—On August 1st, 1918, before any work had been done, a general sample of the outcrop taken by the writer assayed 37.5 per cent. manganese. Other samples taken by the Provincial Mineralogist and Mr. Mackenzie across one section of the outcropping that had been stripped assayed as per the following table:—

Sample No.	Manganese.		Silica.		Iron.		Phosphorus.		Sulphur.		Length of Sample on Incline.
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	
											Ft. In.
1	16.75	15.88	64.3	62.82	..	2.82	..	0.048	..	0.073	2 6*
2	23.05	23.15	50.0	49.60	..	2.80	..	0.046	..	0.058	2 6
3	40.05	52.25	14.5	13.20	..	0.84	..	0.058	..	0.056	5 0
4	55.34	57.15	11.0	10.09	..	0.87	..	0.047	..	0.075	5 0
5	50.62	52.20	17.2	16.88	..	0.90	..	0.041	..	0.167	5 0
6	52.60	53.50	17.2	16.92	..	1.17	..	0.041	..	0.107	3 0
7	44.60	45.90	29.2	25.66	..	1.83	..	0.048	..	0.122	2 0†

* Bottom. † Top.

Analyses A were made by British Columbia Bureau of Mines and analyses B by Department of Mines, Ottawa.

Black Prince Group.

This group of mineral claims was examined on August 3rd, 1918, and while the recent discoveries of deposits of manganese in this locality are of very considerable importance, for one reason because the ore occurs in the same cherty jasperized rock as it is found in on the *Hill 60* group, about twenty-five miles in a south-easterly direction, but apparently there is not such a quantity of high-grade manganese ore on the *Black Prince* as occurs on the *Hill 60* group. It would appear from the results of assays of samples taken from the *Black Prince* group that it would be necessary to concentrate this ore in order to obtain a commercial product.

There appears to be an excellent opportunity to install concentrating-works on the property, as the middle branch of Shaw creek, which flows through a portion of the property, could furnish ample water for concentrating purposes, and possibly water-power could be developed on the main Shaw creek sufficient to drive all the necessary machinery connected with such a plant.

Assays of the samples taken by G. C. Mackenzie, as well as by the writer, show that the ore on the *Black Prince* group varies between 22.2 and 40.8 per cent. in manganese. The workings so far have not exposed any such high-grade manganese content as is shown across 13-foot samples by Mr. Mackenzie on the *Hill 60* group, but the quantity of ore exposed by the strippings and open-cuts on the *Black Prince* group appears to be greater than the quantity exposed on the *Hill 60* group.

The *Black Prince* group of mineral claims is located on a prominent ridge overlooking the middle fork of Shaw creek and about a quarter of a mile from the creek. The location is about six miles by survey-line from the head of Cowichan lake and approximately 1,000 feet elevation above sea-level. The property is reached by following a good trail from the grade of the Canadian Northern Pacific Railway up Shaw creek. The group consists of three mineral claims, called the *Black Prince*, *Black Prince No. 2*, and *Black Prince No. 3*, and is owned by C. H. Dickie, of Duncan; John Noble, John Anderson, and Thos. Service, of Riverside, Cowichan Lake.

Geology.—Deposits of manganese ore on the *Black Prince* group occur in a belt of cherty jasperized quartzose rock of undetermined extent, apparently similar and probably a continuation of the belt in which the ore-deposits on the *Hill 60* group occur.

Characteristics of Ore-deposits.—So far as the work done on the property up to the time it was examined shows, it would appear as though a portion of the deposits of manganese ore are of residual occurrence, while at one point in particular the ore appears to fill a fissure in the sheared zone of cherty rock. It is difficult to determine the exact line of strike, but apparently it is north-westerly, conforming with the general strike of the shearing in the belt of rock in which the ore-bodies occur. The dip where it is exposed is about 30 degrees toward the south.

Development-work.—Development-work consists of stripping and open-cut work at four different points within an area of about 10 acres. At one point the ore is exposed by stripping about 50 feet in length along the strike and 10 feet wide and about 5 feet deep; at another point about 60 feet south-east from the open-cut just mentioned the ore-body is stripped for about 50 feet at a crosscut, the work being nearly at right angles to the stripping and open-cut first mentioned. About 75 feet north-westerly from the first-mentioned cut manganese ore is exposed in a shallow open-cut, and between these showings there is a hollow or depression with indications that ore may occur under the detritus which forms the overburden. At another point about 100 feet north-easterly from the crosscut stripping an open-cut has been made about 80 feet long and about 10 feet wide on a bluff.

Samples and Assays.—The following are the assay results from samples taken by G. C. Mackenzie:—

Sample.	Manganese.		Silica.		Iron.		Phosphorus.		Sulphur.		Length of Sample on Horizontal.
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	
											Feet.
11.	22.2	22.9	55.9	57.24	..	1.03	..	0.031	..	0.148	10*
12.	26.6	28.1	50.8	49.40	..	1.08	..	0.029	..	0.172	10
13.	26.8	27.0	52.0	51.86	..	0.86	..	0.029	..	0.162	10
14.	35.2	35.6	39.0	37.36	..	1.14	..	0.031	..	0.206	10
15.	37.2	40.8	32.2	30.18	..	0.80	..	0.029	..	0.140	7†

* Upper end of dip. † Lower end of dip.

Analyses A were made by British Columbia Bureau of Mines and analyses B by Department of Mines, Ottawa.

The following are assay results of samples taken by the writer:—

No.	Manganese.	Insoluble.	Iron.	Phosphorus.	Sulphur.
	Per Cent.	Per Cent.	Per Cent.		
1.	34.0	48.0	2.1	Trace.	Trace.
2.	29.6	46.8	1.5	"	"
3.	38.0	41.7	2.0	"	"
4.	27.6	54.9	1.8	"	"

Panther Group.

This group contains several mineral claims, known as the *Panther*, *Panther Nos. 1* to 7, inclusive, which were staked by the late Ike Holman, of Riverside, Cowichan lake, in the late fall of 1916. The group was examined on August 9th, 1918. The location of this group of mineral claims is on a creek tributary to the Nitinat river, about two miles in an easterly direction from the grade of the Canadian Northern Pacific Railway, about eight miles from the head of Cowichan lake. The claims are at an elevation of about 1,600 feet above sea-level in a rugged mountain range. The property is owned by the Nitinat Copper Company, Limited, of Victoria, B.C.

Geology.—There is a zone of contact metamorphism on the *Panther* group of undetermined extent. The rocks are limestone and igneous rocks, with a zone of metamorphism developed where the limestone contacts with hornblendic igneous rocks, in which the crystals of hornblende are quite well defined and prominent, as well as several well-defined intrusive dykes, one of which has apparently intruded through a body of mineral composed chiefly of pyrrhotite. On the northerly side of a creek tributary of the Nitinat river there occurs a belt of garnetite, but this does not appear to extend across the creek, nor has its dimensions been determined.

Characteristics of Ore-deposits.—The main outcropping of copper minerals occurs on the *Panther No. 1* claim and is a deposit belonging to the contact-metamorphic type of ore occurrences. It is exposed by an open-cut about 35 feet long which crosscuts a mineralized zone about 3 feet wide from east to west (mag.). The mineralized zone strikes north and dips 37 degrees to the west. This outcrop has been stripped for about 20 feet long. A sample from this open-cut assayed: Gold, trace; silver, 0.4 oz.; copper, 3.8 per cent. A second sample from the garnetite portion of the zone assayed: Gold, trace; silver, trace; copper, 0.2 per cent.

Blue Grouse Group.

This group of three mineral claims was described in the Reports of 1915, 1916, and 1917, so that it is unnecessary to repeat the description in detail in this report. The property was examined on August 7th, 1918. During 1918 development-work has been carried on continuously under the management of C. H. Kilbourne. This work has included both the extension of working openings underground and borings by diamond-drilling. The copper ore mined during 1918 from the underground development has been shipped to the Trail smelter for treatment. This has amounted to about 500 short tons. The results from diamond drilling are reported as fairly satisfactory, and it is expected that further development-work will be done in 1919 with the view of placing the property in the ranks of regular shippers.

Saltspring Island Section.

Saltspring Island section of the Victoria Mining Division includes all of the area covered by the island of that name, which is one of the largest islands lying between Vancouver island and the mainland of British Columbia.

Portions of Saltspring island were examined by J. A. Allan, of the Canadian Geological Survey, during 1909. His report is published in the Summary Report for that year. In this he states that the examination was largely from a boat traverse around the shore.

Chas. H. Clapp also refers to the south end of Saltspring island in Memoir 36, "Geology of the Victoria and Saanich Map-areas, Vancouver Island, B.C.," Canadian Geological Survey, 1913, but there appears to have been no detailed report made as to the geologic conditions on the northern part of the island. Clapp describes an occurrence of iron ore on Saltspring island on the north-western slope of Mount Sullivan, opposite Sansum narrows, at an elevation of about 825 feet above sea-level.

This is, so far as has been reported, the only occurrence of metallic minerals on the island. It was examined by the writer on March 31st, 1918, and is described as follows:—

Mesabi Group.

This group contains two mineral claims, known as the *Mesabi* and *Gogebic*, and is located on the north-westerly slope of Mount Sullivan and contains the same occurrence of iron ore as referred to in Clapp's report. It is reached by boat from either Maple bay, on the east coast of Vancouver island, or Vesuvius bay, on Saltspring island, to a point on the east shore of Sansum narrows, from which a poor trail is travelled up the side of Mount Sullivan to near the summit where the outcroppings of iron ore occur. The group is owned by C. H. Dickie and T. A. Wood, of Duncan.

Geology.—The rocks on the westerly slope of Mount Sullivan belong to the Sicker series, which, according to Clapp, include andesitic volcanic flows and tuffs, with interbedded tufaceous, slaty, and quartzose sediments metamorphosed into schists and intruded by quartz, feldspar, and

gabbro diorite porphyrite, conformable with the Vancouver volcanics, and distinguished from them chiefly by their schistose character, greater mineralization, and by the presence of sedimentary members.

Characteristics of Ore-deposits.—The occurrence of iron ore on the *Mesabi* group of mineral claims occurs as a representative of the impregnated schist type of ore-deposits. (*See* Clapp's report on "Southern Vancouver Island.") The iron ore occurs in the Sicker schists as bands or streaks and lenses, some of which are masses of fair extent, such as about 150 feet long and 20 feet wide, of practically solid iron ore. The occurrences seen by the writer occur in a contact between green schist typical of the Sicker schist and a dark-red jaspery schist which Clapp refers to as having been converted from the typical Sicker schist. The strike is easterly (mag.) and dip 70 degrees to the south.

The impregnated zone is about 100 feet wide, but the width of solid iron ore in the zone varies from streaks a few inches wide to masses about 20 feet wide. From one of these lenticular masses a sample assayed: Iron, 30 per cent.; sulphur, trace; phosphorus, 0.2 per cent.; silica, 53.3 per cent.; titanium, *nil.* A second sample from an open-cut at a level about 150 feet lower than the sample referred to assayed: Iron, 39.5 per cent.; sulphur, trace; phosphorus, 1.02 per cent.; silica, 39 per cent.; titanium, *nil.*

Some of the ore in this deposit is partly altered from magnetite to hæmatite, which accounts for the red streak that can be seen by scratching some samples of the ore.

There are other outcroppings exposed by smaller open-cuts in which the mineralization is composed principally of pyrrhotite, with a very little copper sulphide ore associated. It has not yet been determined whether there is any relationship between the several outcroppings. The property shows possibilities sufficiently promising to warrant thorough prospecting, especially since rails are being laid on the Canadian Northern Pacific Railway, which in the near future will furnish excellent transportation facilities.

Jordan River Section.

The Jordan River section of the Victoria Mining Division includes all of the Coast region of Vancouver island to north-westerly of the mouth of the Sooke river, at Sooke harbour, to the Lost river, which flows into the strait of Juan de Fuca about twelve miles north-westerly of the mouth of the Jordan river. The region is included in Clapp's report on "Southern Vancouver Island." In the description of the geologic conditions it is referred to as being made up of a wide belt of the Metchosin volcanics, a subdivision of Dawson's Vancouver series, which is at least from five to seven miles wide in the Jordan River section, and separated from the rest of the members of the Vancouver group by the Leech River formation. The Metchosin volcanics are composed of ophitic basalt flows, tuffs, and agglomerates, with intrusive diabase dykes, and are less metamorphosed than the rest of the Vancouver group.

Sunloch and Vulcan Groups.

Up to the present time development-work in the Jordan River section of the Victoria Mining Division has been confined to the *Sunloch* and *Vulcan* groups of mineral claims, owned by the Sunloch Mines, Limited, of Vancouver, which were described in the Report for 1917, pages 265 to 267. The development-work on these groups of claims is shown on the accompanying sketch. The property was examined several times during 1918 and the progress of the development watched with great interest, because as the work progressed it became more evident that the property promised to develop into a big mine.

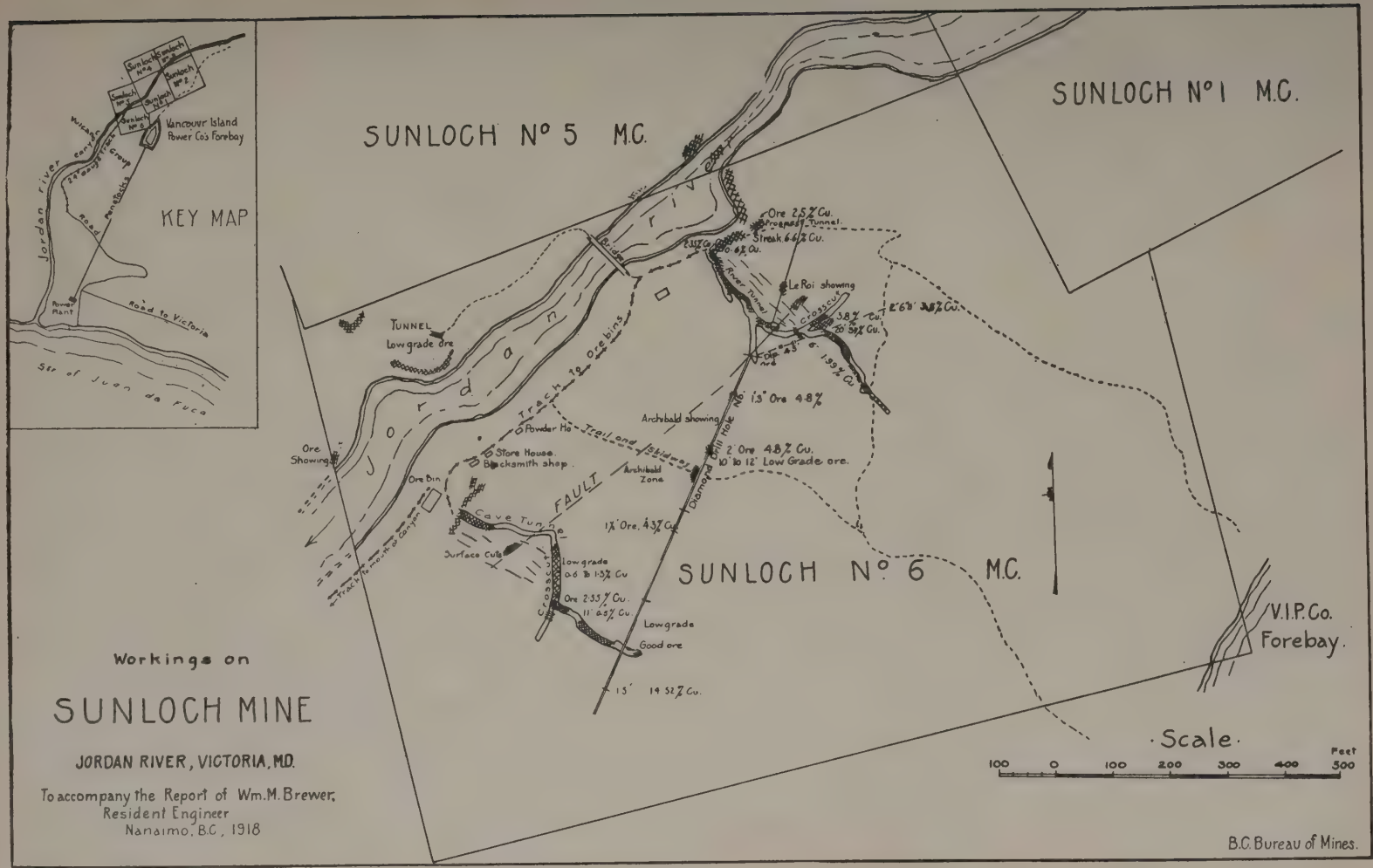
Characteristics of the Ore-deposits.—There are three well-defined ore-bearing zones, which are known as the River, Cave, and Archibald zones, and the work on these is fully described in the following extracts from the report of the managing director, R. H. Stewart, as follows:—

"*River Zone.*—Owing to the difficulty in following the ore-deposit, the tunnel ran out of the ore-zone for a short time. We went back to where the ore was lost and attempted to follow ore which was there visible, finding only disconnected stringers which did not appear to be directly in the ore-zone. After following these for some distance a crosscut was started across the zone and opened up:—

"First: Five to six feet of ore assaying 1.9 per cent. copper.

"Second: A low-grade area with one or two narrow streaks of ore of fair grade.

"Third: Twenty feet of the crosscut averaged 3.7 per cent. copper. As the crosscut is apparently not quite at right angles to the line of the ore, this probably represents 15 or 16 feet of vein.



Workings on

SUNLOCH MINE

JORDAN RIVER, VICTORIA, M.D.

To accompany the Report of Wm. M. Brewer,
Resident Engineer
Nanaimo, B.C., 1918

"Fourth: A band of waste 6 feet wide.

"Fifth: About 3 feet of ore averaging 3.8 per cent. copper. From this point on the crosscut is in waste for 40 feet, but owing to the surface showing will have to be continued at a later date.

"In the meantime a drift which was started in the zone just west of the high-grade ore has been extended to 60 feet beyond the crosscut. The drift is now in good ore, averaging to date over 4 per cent. copper. The development-work on this zone has therefore opened up partially 280 feet of vein, the end of the drift being probably from 230 to 250 feet vertically below the surface.

"The nature of the higher grade ore encountered is such that it could, to a very great extent, be sorted and shipped, leaving a certain amount which would have to be milled. Should this ore prove to be continuous from the mouth of the tunnel, which seems to be quite likely, a very considerable tonnage is available.

"In addition to this ore, the prospect-tunnel shown on the map about 100 feet east of the main River tunnel exposed another zone of ore averaging in the prospect-tunnel about 2.5 per cent. copper. This has apparently not been reached by the crosscut, but will be prospected for further with the diamond-drill at an early date.

"*Cave Zone.*—In this zone the tunnel also left the ore at about 60 feet from the mouth, getting into a low-grade area with a few stringers of high-grade ore in it, the first 60 feet of the tunnel having been in ore averaging about 4 per cent. At 180 feet in a crosscut was started to the south, and after going through one section of about 60 feet of low-grade material averaging 0.9 per cent., of which 10 feet averages 1.3 per cent., the crosscut encountered 20 feet of waste; then 36 feet of ore averaging 2.58 per cent., of which one section of 11 feet averaged 5.1 per cent.; from this point to the end of the crosscut being in low-grade material averaging 0.64 per cent. The crosscut is being continued. The point at which the high-grade ore was encountered is 240 feet horizontally from the surface, and very nearly the same vertically.

"In addition to this development, a horizontal diamond-drill hole was run from a point in the River tunnel to crosscut both this zone and a third zone lying between the Cave and River zones, known as the Archibald zone. This diamond-drill hole at a depth of about 500 feet meets the Cave zone about 150 feet farther in than the crosscut, and encounters first a section of low-grade ore with one small streak of 6 inches carrying 7.9 per cent. copper; then 4 feet averaging 1.19 per cent.; then 5 feet of 3.48 per cent., 3½ feet of 0.65 per cent.; then 2 feet of 3.8 per cent. ore, corresponding possibly to the 11 feet of high-grade ore shown in the crosscut. Unfortunately after this the drill-hole encounters faulted and broken ground, and with the exception of 4½ feet of ore which has not yet been sampled, there is not much except low-grade material in the remainder of the hole. It is quite probable that this is due to the faulting.

"The net result is that this zone is partially proved to a distance of nearly 400 feet from the surface, both horizontally and vertically: (1) By open-cutting at the mouth of the tunnel and by the first 60 feet of the tunnel: (2) by a crosscut at 220 feet from the surface; (3) by the diamond-drill hole 400 feet from the surface. In all of these places ore of good width and grade has been found. The prospects of this zone, therefore, may be considered to be good.

"*Archibald Zone.*—On this zone there is an open-cut on the surface showing some good-grade ore about 260 feet above the level of the River and Cave tunnels. What is presumed to be the same zone is crosscut below by the diamond-drill hole and shows 2 feet of ore running 4.87 per cent. copper, in addition to 10 or 12 feet of low-grade material, the drill-hole being on the level of the tunnels. This zone may therefore be considered to have fair possibilities.

"In addition to this ore, the drill-hole encountered two small streaks of about 1½ feet each, averaging in one case 4.8 per cent. copper and in the other 4.3 per cent.

"*General.*—On the opposite side of the Jordan river some open-cutting has been done on the Cave zone, showing that it crosses the river into the *Vulcan* group of claims. On this side of the river there is a short tunnel on the Archibald zone showing some low-grade ore, and there are outcrops on the River zone which have not been prospected to any extent.

"The work on the narrow-gauge railroad exposed two other ore-zones, in one case on the edge of a rock-cut, and in the other case the grade merely passed beside an excellent outcrop of good width; this latter on the *Vulcan* group, on which it will be advisable to do some work as soon as possible.

"On the dump and in the bins are about 1,000 tons of ore which should average better than 3 per cent. copper. The greater part of this can be sorted to a much higher grade for shipment.

In a general way the ore so far exposed is of such a nature that a large part of it can be sorted to a high enough grade for shipment independently of milling, so that the property should be able to get returns from mining even before a mill can be built.

"Summing up the possibilities of the above, should the ore in the River zone prove to be continuous to the inner end of the drift from the surface, a tonnage of from 35,000 to 50,000 tons is possible of ore between 2.5 and 4 per cent., with a probable addition of some ore of lower grade, without including any ore which is shown in the little prospect-tunnel and without including ore beyond or underneath the tunnel. In the Cave zone, measuring similarly, there is a possibility of 80,000 to 120,000 tons of ore running from 3½ to 5 per cent., and of a further considerable tonnage between 1.7 and 2.5 per cent. This is, of course, not yet entirely proven; but, on the other hand, it will be understood that the development so far done only covers a very small part of the possible ore-bearing area of the property, and that in addition to this area, which is all above the level of the river, further prospecting will eventually be done below the level of the river.

"In general, therefore, the prospects of the property are very good, and it well warrants further development."

East Sooke Section.

The mining industry in the East Sooke section of the Victoria Mining Division was not as progressive during 1918 as has been the case during the previous year. Some shipments of copper ore were made from the *Margaret* or *East Sooke* group, as well as from the *Willow Grouse* group, but development-work on both of these properties was suspended subject to the negotiations that were pending relative to change of ownership.

ALBERNI DISTRICT.

ALBERNI MINING DIVISION.

A. G. FREESE, GOLD COMMISSIONER.

I have the honour to submit a brief annual report on mining in the Alberni Mining Division during the year ending December 31st, 1918.

Monitor Group.—This group, situated on the west shore of the Alberni canal, has been continuously worked during the year up to September 15th, when the mine was closed down. The development-work consisted of 284 feet of drifting, 50 feet of crosscutting, and 110 feet of raising, all done on what is known as the "New Discovery ore-body," which is situated close to tide-water on the *Monitor No. 1 Fraction.* This ore-body has an approximate width of 50 feet and is proven for a length of 400 feet. From the above development-work a shipment of 126 tons of ore was made to the smelter at Tacoma, which gave promising results. A water-level trail was also constructed from the camp buildings to the New Discovery tunnel, a distance of 4,500 feet.

Beyond the keeping-up of the yearly assessment-work on a number of claims and the above-mentioned work on the *Monitor* group, very little actual mining development has taken place during the year.

OFFICE STATISTICS—ALBERNI MINING DIVISION.

Free miners' certificates issued	31
Certificates of work recorded	29
Mineral claims recorded	22
Bills of sale recorded	2
Total revenue	$742.10

CLAYOQUOT MINING DIVISION.

REPORT OF WALTER T. DAWLEY, MINING RECORDER.

I have the honour to submit the annual report on mining operations in the Clayoquot Mining Division for the year ending December 31st, 1918.

Assessment-work has been recorded as follows:—

Copper Ledge.—Situated on the north end of Vargas island and owned by Donald Mackintosh. Blasted about 500 tons of rock and made an open-cut 14 x 4 feet by 3 feet deep on strike about 60 yards south-east of discovery post.

Lucky Jim.—Situated on Elk river and owned by William Spittal. Stripped about 70 x 2 x 4 feet of earth and logs, cleared out the trail, and other necessary work, including 2 feet of solid rock 4 x 6 feet.

White Mine and Norman.—Situated at Deer creek and owned jointly by William Walton and Duncan McMillan. Two hundred feet of surface work and half a mile of trail and other prospecting-work.

Crown.—Situated on Lone Cone mountain and owned by Stuart Stanley Stone. Driving tunnel and opening up face of mineral at location post.

Contact.—Situated at Muchalet arm and owned by T. T. Gardhouse and W. F. Poole. Sunk shaft 6 x 8 feet by 15 feet deep at face, partly rock-work.

Northern Crown.—Situated at Kennedy lake and owned by J. E. Martin. Eight feet of shaft-work and open-cut; about 50 feet of loose rock.

Lucky Jim.—Situated at Bear river and owned by J. D. McLeod. Eight feet of tunnelling, all rock-work, 4 x 6 feet.

Wanderer Group.—Situated at Elk river and owned by Lachlan Grant. Open-cut 20 feet long, 12 feet wide, loose rock, and some drilling; about 8 feet of open gap and 5 x 6 x 4 feet of tunnel; 12 x 14 feet of solid rock removed; tunnelling, 8 feet.

Bunk-house, Sunloch Mine, Victoria M.D.

Narrow-gauge Railway, Sunloch Mine, Victoria M.D.

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Office Statistics—Clayoquot Mining Division.

Free miners' certificates (individual)	30
Mineral claims recorded	24
Certificates of work recorded	12
Other receipts issued	1

Revenue.

Free miner's certificates	$137 25
Mining receipts, general	90 25
Total	$227 50

QUATSINO MINING DIVISION.

Report of O. A. Sherberg, Mining Recorder.

I have the honour to submit the annual report on the mining operations in the Quatsino Mining Division for the year ending December 31st, 1918.

The *Old Sport* property has been developed continuously during the year, with an average crew of about thirty men. The principal work consisted of sinking and running crosscuts to block out the ore. It is reported that they are to start the working-tunnel of about 3,000 feet that will bring them to a level of 700 feet. The railroad from June Landing to the mine is to be started this winter.

During the summer and fall a party with a diamond-drill has been working on the *Old Sport*; the report of the result is good.

Office Statistics—Quatsino Mining Division.

Mineral claims recorded	56
Certificates of work	61
Powers of attorney, transfers, etc.	14
Certificates of improvements	44
Free miners' certificates	152

NANAIMO DISTRICT.

NANAIMO MINING DIVISION.

REPORT OF S. McB. SMITH, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on the mining operations in the Nanaimo Mining Division for the year ending December 31st, 1918.

Marble Bay. During the past year the *Marble Bay* group, situated on Texada island, shipped regularly copper-gold-silver ore from the 1,600-foot level. The company employed throughout the year an average of thirty-five men in connection with the operations.

Retriever Wm. McDonald and W. Lee reorganized the company working the *Retriever* group, Texada island. Considerable development-work has been done, including the building of a tram-line from the beach to the mine, a distance of about three-quarters of a mile; also constructing wharf and bunkers at the beach and a concentrating-mill.

The *Little Billie*, *Copper Queen*, *Cornell*, and *Loyal* have been leased by a Seattle syndicate, which did some development-work on the *Loyal*.

The Valdes Island Copper Company is developing the *Copper Mountain* group on the south end of Valdes island, near Quathiaski cove, and made several shipments of ore, most of which was taken from the *Senator* claim.

The *Santa Anna* group, situated on the south end of Valdes island, near Bold point, had a little development-work done during the year, and will likely have considerable work done during the ensuing year by capitalists who have leased the property.

Prospecting-work was done on the *Amethyst* and *Monte Cristo* claims, Fanny bay, Phillips arm, which resulted in mining of about 90 tons of ore of commercial grade, but owing to the conditions with regard to shipping and smelting this ore was left on the dumps.

During the year Wm. M. Brewer, Resident Engineer for the Western Mineral Survey District (No. 6), which includes the whole of the Nanaimo Mining Division, has examined a great many properties in this Mining Division. His report will contain descriptions and details of the important properties in this Mining Division, so I shall not attempt detailed descriptions.

With the exception of the above, very little work has been done, other than the annual assessment-work, which has been recorded on a large number of claims, as shown by the accompanying office statistics.

OFFICE STATISTICS—NANAIMO MINING DIVISION.

Mineral claims recorded	128
Certificates of work	164
Bills of sale, etc.	35
Free miners' certificates	235

Revenue.

Free miners' certificates	$1,344 00
Mining receipts, general	2,411 75
Total	$3,755 75

VICTORIA DISTRICT.

VICTORIA MINING DIVISION.

Report of Herbert Stanton, Gold Commissioner.

I have the honour to submit the annual report on the mining operations in the Victoria Mining Division for the year ending December 31st, 1918.

Lode-mining.

There has been considerable activity in mining in this Division during this past year, with already some material shipments, and if one can judge from the success met with by several of the companies in their development-work, there should be within the next few years an output of copper ore which will place this Division in the list of important copper-producing districts.

In the Cowichan Lake district the *Blue Grouse* shipped approximately 500 tons of ore averaging nearly 5 per cent. copper, while the *Sunnyside*, in the same locality, also made some small shipments.

The *Blue Grouse* has been acquired by the Consolidated Mining and Smelting Company, of Trail, and is now being worked by that company. On this group of mineral claims the work done during the past season has been extending the old underground workings and doing very extensive prospecting by trenching and diamond-drill boring. The ore shipped has been such as was mined from the prospect openings and the underground extensions.

Manganese Ore.—The discovery of deposits of manganese ore in the mountains adjacent to Cowichan lake during the past summer attracted considerable attention. These deposits occur in a zone of jasperized cherty rock, and were discovered at three distinct points within a distance of about twenty-five miles; the most south-easterly occurrence, known as *Hill 60*, is about four miles from the foot of Cowichan lake, and the most north-westerly is about eight miles above the mouth of Shaw creek, which empties into the lake about five miles from its head. A limited amount of prospecting-work was done on the various claims by the locators, who propose to do further development in the coming season and place the properties on a shipping basis. The property is controlled by C. H. Dickie, of Duncan.

In the Sooke district, the *Margaret*, operated by a Victoria company, shipped some 130 tons of 5-per-cent. copper ore, and the indications are that during the coming year regular shipments will be made.

The *Willow Grouse* made shipments this year of 550 tons while bonded to the Ladysmith Smelting Corporation.

Both these properties are sufficiently near the navigable waters of Sooke harbour to permit of shipments being made by scows.

The geological formation upon which both the *Willow Grouse* and *Margaret* are located has been found to extend at least to the Jordan river, where the Sunloch Mines, Limited has been opening up what promises to be a very extensive low-grade copper property within two miles from the power-station of the British Columbia Electric Company. The work on this property has been confined to development in a systematic manner. There has been about 800 feet of drifting and crosscutting and about 400 feet of diamond-drill boring done on this property, in addition to the construction of about 6,000 feet of automobile-road, the installation of a 4-drill compressor plant, and construction of new camp buildings.

As the Victoria Mining Division is included within the Western Mineral Survey District, and the Resident Engineer, W. M. Brewer, is making a very detailed report thereon, it will be unnecessary for me to enter into further particulars.

Placer-mining.

I am not aware of any placer-mining having been carried on in the Division this past year, although it is possible some small amount of gold may have been taken out from the Leach, Jordan, and Sooke rivers which has not been reported.

NON-METALLIC MINERALS.

The non-metallic minerals in this section have chiefly been utilized in some form of building material, and, as the building trade and allied industries have been nearly dormant for the past two years, this branch of the mineral industry has been seriously depressed.

Cement.—There are two large and well-equipped cement plants in the Division, both situated on Saanich inlet. The Vancouver Portland Cement Company, of Tod inlet (R. P. Butchart, president, Board of Trade Building, Victoria), made an output of Portland cement, of a value of nearly $300,000. This company also manufactured for the Associated Cement Company, whose works at Bamberton were not operated this past year. It was reported about the close of the year that these two companies had been amalgamated into one.

Lime.—The Rosebank Lime Company (W. F. McTavish, manager), Esquimalt, produced burnt lime to a value of about $6,000, which is about the same as last year's output. The Lime Producers, Limited, made almost $5,000 worth of lime.

Of pottery, tile, etc., there was produced, this past year, material valued at about $40,000, chiefly by the British Columbia Pottery Company, whose plant is situated in Victoria district, but has recently been discontinued.

In normal times there is a large number of red brick, etc., made in this Division, but this past year the production did not exceed in value $20,000, produced chiefly by the Victoria Brick Company and the Sidney Island Brick Company.

OFFICE STATISTICS—VICTORIA MINING DIVISION.

Free miners' certificates issued	401
Free miners' certificates issued (special)	1
Mineral claims recorded	118
Placer claims recorded	6
Certificates of work recorded	101
Bills of sale recorded	39
Certificates of improvements issued	7

Revenue.

Free miners' certificates	$2,791 75
Mining receipts, general	977 58
Total	$3,769 33

VANCOUVER MINING DIVISION.

Report of A. P. Grant, Mining Recorder.

I have the honour to submit the following report of mining operations in the Vancouver Mining Division, from August 1st to December 31st, 1918:—

The following list gives the number and localities of the recorded claims in this Division:—

Mineral Claims.

McNab creek	4
Nelson island	2
Lynn creek	4
Hotham sound	1
Howe sound (west side)	9
Howe sound (east side)	24
Indian river	116
Half-moon bay	2
Capilano	2
Cheakamus and Pacific Great Eastern Railway	17
Bargain harbour	1
Jervis inlet (west side)	27
Jervis inlet (east side)	19
Gambier island	8
Seymour creek	16
Cypress creek	5
Mamquam river	1
Narrows arm	1
Staamus river	2
Mount Wrottesley	17
Total	278

The Britannia Mining and Smelting Company, Limited, having extended its operations to the Indian River district, accounts for the large number of claims located there.

Jervis Inlet district is being prospected to quite an extent, and the owners of the groups already located are keeping their claims in good standing.

The Red Jacket Development Company states that owing to the high price of labour and supplies the work was confined chiefly to prospecting and assessment work. The work done on the *Red Jacket* group proved the existence of a higher grade of ore than was previously known to exist, and, judging from the surface indications, it is expected that the vein will prove to be from 20 to 50 feet wide. The company intends to diamond-drill the property extensively during the coming season.

The Baramba Mining Company has kept its claims in good standing, but owing to war conditions very little other development-work has been done.

The *Alta Lake* group of claims, situated near Mons, has had a spur built in from the main line of the Pacific Great Eastern Railway and had about twenty men employed for a time getting out bog-iron ore. Mr. Thompson, one of the owners, states that the company has shipped about 900 tons of dry bog-iron ore (equal to about 1,200 wet tons) to the Irondale smelter at Port Townsend. This shipment gave an average of 46 per cent. metallic iron. The shipment was sent for experimental purposes and was used with magnetite ore and mill-sinter. After the working by steam-shovel was stopped and the work done by hand-labour, the percentage of iron increased from 43 to 49 per cent. The company is now in a position to ship up to 150 tons a day.

E. J. Donohue, secretary-treasurer of the *Britannia* mines, has given me the following information concerning the company's operations for the year ending December 31st, 1918. He states:—

"On account of the delay in receipt of settlement sheets from the smelter, final figures covering production are not yet available, but the year's results are contained in the following approximations:—

	Tons.
Ore mined	731,000
Ore transported	729,000
Ore milled	730,000

"The ore milled produced:—

Copper	18,250,000 lb.
Gold	3,040 oz.
Silver	98,100 oz

"Classification of the development-work done in the mine appears below:—

	Feet.
Drifts	9,837
Crosscuts	4,427
Raises	8,754
Chutes	1,541
Winzes	36
Total	24,595

"In the Fairview mine drifts have been extended on previously developed veins, as well as on new ones opened to the south, on which we have commenced stoping operations.

"The outside glory-holes were worked during the open season, approximately seven months, the ore being broken on the top of the mountain into large transfer rock-chutes, from whence it is delivered to the underground crushers with but one handling.

"More extensive operations were carried on in the *Bluff* mine to the west and the *Empress* mine to the east of the *Fairview*, and two drifts were driven west on the *Jane* mine 1,200-foot level, developing this ore-body 200 feet below previous working-level.

"We completed during the past year another connection through Britannia mountain, this being on the 600-foot level, and making the fourth level to have portals on the north and south side of the mountain. The 1,200- and 1,600-foot levels are now being driven for connection, and this work will be completed during 1919.

"The Victoria tunnel, 8 x 8 feet, to the east of the *Empress* workings at the elevation of the 1,800-foot level, has been advanced 400 feet, prospecting the extension of the veins in that section of the property.

"The Hillside tunnel, 8 x 8 feet, is being driven at a point west of the *Jane* mine at the elevation of the 1,000-foot level. This advanced approximately 200 feet.

"The 4,100-foot level tunnel is now in a distance of 4,220 feet, showing an advance for the year of 1,735 feet. A raise has been started at the face of this tunnel and advanced a distance of 100 feet. It is the intention to continue this raise to the 3,100-foot level, a distance of 1,130 feet, and from there to the 2,700-foot level, 370 feet. The raise is being driven on a 65-degree slope, its dimensions being 7 x 12 feet.

"The 3,100-foot level east drift advanced 659 feet. From this drift another drift 260 feet long was driven to the location of the proposed raise to the Armour crosscut, known as the 2,700-foot level, at the west end of our electric transportation system. The Armour crosscut was advanced 502 feet.

"Under the proposed system of tunnels and raises, the mine ore will be handled from the 2,700- to the 4,100-foot level by gravity; thence by railway to the mill, a distance of approximately 5,000 feet, thus eliminating outside haulage and consequent interference by snow.

"In connection with the water developments in South valley, the Harp tunnel, 5 x 6.5 feet, was driven 811 feet to completion, the total length being 2,246 feet.

"In order to prospect new territory and prove the extension of known ore-bodies, considerable diamond-drilling was done during the period under review, footages covering which work are as follows:—

	Feet.
Fairview mine	15,062
Empress mine	4,897
Bluff mine	2,404
Jane mine	2,071
3,100-foot tunnel	690
2,700-foot tunnel	1,558
Total	26,682

"Four additional Westinghouse 3½-ton storage-battery mine locomotives were placed in service during the year, making a total of twelve of this type of locomotive now in operation in the mine, in addition to one 6-ton General Electric trolly locomotive and two 3½-ton Westinghouse trolly locomotives.

"We also added to our mine-haulage equipment fifty-four 2-ton automatic side-dump cars, this making a total of 150 cars of this type. In addition to this, twenty cars of the same size and type, but of 3-foot gauge, were purchased for handling ore broken on the 2,200-foot level and for service in tunnels outside of the mine proper.

"To supplement our equipment on the outside electric-haulage system, we placed in service one 40-ton General Electric locomotive and one 8-ton, making the present equipment in this service: One 40-ton locomotive (electric trolly); four 15-ton locomotives (electric trolly); one 8-ton locomotive (electric trolly); ten 20-ton bottom-dump cars; twelve 20-ton side-dump cars; two flat cars.

"One 8-room dwelling-house was erected at the Townsite camp, replacing similar structure destroyed by fire earlier in the year. We also constructed a concrete root-house, the outside dimensions being 38 x 30 feet, with inside height of 9 feet, to provide accommodation for vegetables, etc., at the Tunnel boarding-house.

"Considerable development-work in the nature of diamond-drilling and tunnels was done on our Indian River District purchases, and this work is being vigorously carried on at the present time.

"In conclusion, would add that our operation was seriously interfered with during the months of October and November on account of the Spanish influenza epidemic."

C. M. Oliver, secretary of the Bowena Copper Mines, Limited, states:—

"During the early part of the year 1918 no development-work was done at the *Bowena* mine, Bowen island. In July the property was leased for a term of five years to C. W. Tipping, the lessee to erect a concentrating plant of at least 100 tons a day capacity. Mr. Tipping has had the building completed and in readiness for the reception of the machinery since October, and expects to have plant installed and in operation by March 1st. In the meantime a dam has been built to increase the water-supply for camp and mill purposes; an electric-lighting plant is being installed and ore blocked out in preparation for milling operations."

The *Bulliondale* group of claims, situated on the westerly side of *Indian* river and adjoining the *Belle* group, has been Crown-granted this year by the owner, Robt. Mungall, of Vancouver.

The *Belle* group, owned by Herres & Habrich, of Squamish, has been kept in good standing, the owners continuing the tunnel on the *Irish Molly* claim for the group.

A large number of transfers have been made of other claims in the Indian River district, and the fact that the new owners wished to test out these properties is to some extent responsible for the large number of certificates of work issued in excess of previous years.

The Lynn Creek Zinc Mines Company, Limited, has done the necessary assessment-work on its claims not yet Crown-granted, and are preparing to Crown-grant them all shortly.

On Potato creek, Jervis inlet, nine placer leases were issued to L. F. Green, of Vancouver, and his associates. Four of these leases have been assigned to the Four-twenty Gold Bar Placer Mining Company, Limited. All of these leases were consolidated and development-work recorded for the same.

The following is a statement of work done in this office during the year, and the revenue received shows an advance of $3,356.35 over the previous year:—

OFFICE STATISTICS—VANCOUVER MINING DIVISION.

Free miners' certificates issued	1,799
Special free miners' certificates issued	15
Company free miners' certificates issued	43
Claims recorded	278
Abandonments recorded	25
Certificates of work issued	856
Surveys recorded as work	35
Receipts issued for money in lieu of work	34
Notices filed	79
Conveyances recorded	146
Certificates of improvement recorded	68
Powers of attorney recorded	15
Placer leases issued	9
Placer conveyances recorded	8
Crown grants applied for	68

Revenue.

Free miners' certificates	$10,741 70
Mining receipts	8,971 25
Total	$19,712 95

NEW WESTMINSTER MINING DIVISION.

REPORT OF IRVING WINTEMUTE, MINING RECORDER.

I have the honour to submit the following report of mining operations in the New Westminster Mining Division for the year ending 1918:—

The list below gives the number and vicinities of claims recorded in this Division during the past year:—

Chilliwack lake	9
Harrison lake	26
Sumas lake	6
Chilliwack river	4
Jones lake	3
Stave river	6
Pitt lake	30
Total	84

As will be seen by the accompanying office statistics, the mining industry has not shown much activity during the past year; in fact, in almost every case the statistics show a decrease of business done.

The operations were confined to annual assessment-work only, with the exception of the *Lucky Four* group, on which sufficient work was done to enable the owners thereof to obtain certificates of improvement on the group, consisting of twelve claims. As the New Westminster Mining Division is included within the Western Mineral Survey District, and the Resident Engineer, W. M. Brewer, is making a report thereon, I assume it is unnecessary for me to enter into particulars.

Cheam Range, Highest Peak.

Cheam Summit, New Westminster M.D.

Office Statistics—New Westminster Mining Division.

Free miners' certificates issued (individual)	130
Free miners' certificates issued (company)	1
Free miners' certificates issued (special)	1
Mineral claims recorded	84
Certificates of work issued	97
Conveyances, etc., recorded	9
Grouping notices filed	9
Receipts issued for money in lieu of work	5

Revenue.

Free miners' certificates	$ 693 00
Mining receipts	1,138 85
Total	$1,831 85

INSPECTION OF MINES.

REPORT OF GEORGE WILKINSON, CHIEF INSPECTOR.

I have the honour to submit my second annual report as Chief Inspector of Coal and Metalliferous Mines covering the year ending December 31st, 1918.

The reports of the District Inspectors relative to production of coal and coke, the number of persons employed, list of accidents and prosecutions, and brief description of the mines in the several inspectorates, and also reports of the Instructors in Mine-rescue Work and First Aid, are hereto appended.

PERSONNEL OF STAFF OF INSPECTORS AND INSTRUCTORS.

The personnel of the staff of Inspectors and Instructors is as follows:—

Inspectors.

Geo. Wilkinson	Chief Inspector, Victoria.
James McGregor	Inspector, Nelson District.
H. H. Johnstone	Temporary Inspector, Nelson.
Robert Strachan	Senior District Inspector, Fernie.
Wm. Lancaster	Inspector, Fernie District.
John Newton	Inspector, Nanaimo District.
Henry Devlin	Inspector, Nanaimo District.
J. H. McMillan	Inspector, Prince Rupert District.

Instructors, Mine-rescue Stations.

John D. Stewart	Instructor, Mine-rescue Station, Nanaimo.
J. T. Puckey	Instructor, Mine-rescue Station, Fernie.
John Thomson	Instructor, Mine-rescue Station, Cumberland.

Organizer and Instructor, First Aid.

Dudley Michell	Instructor, Victoria.

CHANGES IN THE INSPECTION STAFF DURING THE YEAR 1918.

There have been no changes in the inspection staff during the year. The vacancy in the Nicola-Princeton District made by the transfer of Robert Strachan to the Crowsnest Pass District has not yet been filled. The coal-mines in the Nicola-Princeton District have been inspected during the year alternately by Inspectors Newton, Strachan, and Lancaster, and the metalliferous mines by Inspector McGregor.

At the end of August Charles O'Brien resigned his position as Instructor at the Fernie Mine-rescue Station, and J. T. Puckey was appointed to fill the vacancy.

TONNAGE OF COAL PRODUCED.

The total gross tonnage produced by the coal-mines of the Province for the year ending December 31st, 1918, was 2,578,724 long tons, an increase of 180,009 long tons over the production of 1917.

The output would have been considerably larger had not the production been cut down by the following causes: On September 4th a strike was called at the mines of the Crows' Nest Pass Coal Company demanding a single shift, the demand being based on alleged dangerous conditions in the mines due to working two shifts. The strike lasted five weeks; then the mines were ordered opened by Commissioner Armstrong on a single-shift system, pending an investigation into mining conditions by a Royal Commission to be appointed by the Hon. the Minister of Mines, who will report on conditions and determine if any, or all, of the mines should be worked on the single-shift system. The ravages of the influenza epidemic were responsible for a large loss in

output. The East Wellington mine was closed down for the first eight months of the year on account of a fire in the workings. There was also a serious shortage of labour. With the exception of Vancouver Island District, all the others showed an increase.

The Vancouver Island collieries had a decrease in their production from 1,695,721 tons in 1917 to 1,666,211 tons in 1918, a decrease of 29,510 tons.

The Nicola-Princeton District increased its production from 151,243 tons in 1917 to 179,179 tons in 1918, an increase of 27,936 tons.

The Crowsnest Pass collieries increased their production from 551,751 tons in 1917 to 732,864 tons in 1918, an increase of 181,113 tons.

A new mine opened at Telkwa, in the Northern Inspection District, produced 470 tons during 1918.

Accidents in Coal-mines.

The fatalities in and around the coal-mines during the year totalled twenty-eight, of which number sixteen were killed in one accident caused by the breaking of an hoisting-cable on Protection shaft on the morning of September 10th, 1918, which is dealt with in a separate report.

The other fatal accidents which occurred during the year totalled twelve, and were from various causes.

There were 5,427 persons employed in and around the coal-mines.

The ratio of fatal accidents per 1,000 persons employed was 5.159, compared with 8.51 for 1917 and 5.53 for 1916. The ratio for the last ten-year period was 5.089.

The following table shows the collieries at which fatal accidents occurred during 1918, and their relation to accidents which occurred at the colliery for 1917:—

Name of Company.	Name of Colliery.	1918.	1917.
Canadian Collieries (D.), Ltd	Comox Colliery	2	8
Canadian Collieries (D.), Ltd	Extension Colliery	1	..
Canadian Western Fuel Co	Nanaimo Colliery	18	1
Pacific Coast Coal Mines, Ltd	South Wellington Colliery	..	..
British Columbia Coal Mining Co	East Wellington Colliery	..	..
Nanoose Collieries, Ltd	Nanoose Colliery	..	..
Middlesboro Collieries Co	Middlesboro Colliery	..	..
Merritt Collieries, Ltd	Merritt Colliery	..	..
The Fleming Coal Co	Coal Hill Colliery	2	..
Princeton Coal & Land Co	Princeton Colliery	..	..
Coalmont Collieries	Coalmont Colliery	..	..
Crow's Nest Pass Coal Co	Coal Creek Colliery	2	34
Crow's Nest Pass Coal Co	Michel Colliery	3	1
Corbin Coal & Coke Co	Corbin Colliery	..	..
Telkwa Collieries	Telkwa Colliery	..	..
Totals		28	44

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for the previous year:—

Cause.	1918.		1917.	
	No.	Per Cent.	No.	Per Cent.
Fall of rock	6	21.428	3	6.818
Fall of coal	1	3.572	..	.....
Haulage	4	14.286	2	4.545
Explosion (none), rope breaking, and cage falling in shaft	16	57.143	38	86.364
Falling timber	1	3.571	..	.....
Miscellaneous (electrocution)	..	.....	1	2.273
Totals	26	100.000	44	100.000

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the years 1918 and 1917:—

Cause.	1918.		1917.	
	No. of Fatal Accidents.	No. Tons mined per Fatal Accident.	No. of Fatal Accidents.	No. Tons mined per Fatal Accident.
Fall of rock	6	429,687	3	799,572
Fall of coal	1	2,578,724	..	.....
Haulage	4	644,681	2	1,199,357
Explosion	..	.....	..	.....
Rope breaking and cage falling down shaft	16	161,170	38	60,493
Falling timber	1	2,578,724	..	.....
Miscellaneous	..	.....	1	2,398,715

The number of tons of coal mined per fatal accident during 1918 was 92,098, compared with 54,539 tons for 1917 and 76,529 tons for the last ten years.

TONNAGE OF METALLIFEROUS MINES.

The output from the metalliferous mines for 1918 was 2,892,849 tons, being an increase of 131,270 tons over the tonnage for 1917. This tonnage was produced from 175 shipping mines, of which eighty shipped over 100 tons.

ACCIDENTS IN METALLIFEROUS MINES.

There were twelve fatal accidents in and around the metal-mines during the year, causing the death of twelve persons, being a decrease of three in number of accidents and a decrease of five in number of fatalities compared with the figures of 1917.

There were 4,390 persons employed in and around the metalliferous mines, a decrease of 1,098 persons compared with the figures of 1917.

The ratio of fatal accidents per 1,000 persons employed was 3.66, compared with 3.23 for 1917. The ratio for the last ten-year period was 3.899.

The mines at which the fatalities occurred are:—

Mining Division	Mine.	No. of Accidents.
Nass River	Anyox	4
Similkameen	Copper Mountain	1
Greenwood	Motherlode	2
Greenwood	Granby	1
Ainsworth	Florence	1
Trail Creek	Le Roi	1
Skeena	Surf Inlet	1
Slocan City	Eastmont	1
Total		12

The following table gives the cause and percentage to the whole of the fatal accidents, with corresponding figures for 1917:—

Cause.	1918.		1917.	
	No.	Per Cent.	No.	Per Cent.
Falls of ground	6	50	6	35.294
By falling into chutes, raises, winzes, stopes, etc.	4	33.334	2	11.764
By cage in shaft	..	.....	1	5.883
By mine-car and haulage	1	8.333	1	5.883
Picking or drilling into unexploded powder	..	.....	2	11.764
Material falling in shaft	1	8.333	1	5.883
Premature blast	..	.....	3	17.646
Killed while unloading timber from wagon on surface	..	.....	1	5.883
Totals	12	100.000	17	100.000

The falls of ground caused six deaths, or 50 per cent. of the whole, which is an increase in percentage of 14.7 over last year, but being the same number of deaths from the same cause.

There were no accidents from the use of explosives during 1918, compared with five fatal accidents from this source during 1917.

Chute accidents caused the loss of four lives, or 33.333 per cent. of the total this year. There is an increase of two deaths over the number for last year, but an increase in percentage of 21.569.

Falling material in shafts was the cause of one death, being the same number of lives as last year, but an increase in percentage of 2.45. There were no accidents in shafts from any other cause.

During the year the production of minerals was greater in tons than 1917.

There was a general scarcity in labour, and that obtainable generally was less experienced than usual, considerably increasing the risk of accidents.

Explosives.

During the year one supplementary order was issued and added to the permitted list of explosives contained in the previous explosives orders. The full list of explosives now on the permitted list are as follows:—

Monobel A1 ..... British List.
Monobel No. 1 ..... „
Dynobel No. 2 ..... „
Polar Permitite ..... „
Monobel ..... United States List.
Monobel No. 4 ..... „ „
"Giant" Coal-mine Powder No. 5 ..... „ „
"Giant" Coal-mine Powder No. 6 ..... „ „
"Giant" Coal-mine Powder No. 7 ..... „ „
"Giant" Coal-mine Powder No. 8 ..... „ „
Polar Brushite ..... „ „
Vigorite No. 1 ..... „ „
Vigorite No. 2 ..... „ „
Vigorite No. 3 ..... „ „
Vigorite No. 4 ..... „ „
Miner's Friend No. 1 ..... „ „
Miner's Friend No. 2 ..... „ „
Miner's Friend No. 3 ..... „ „
Miner's Friend No. 7 ..... „ „
Viking No. 1 ..... „ „

The following table shows the quantity of explosives used in coal-mines during the year 1918, together with the number of shots fired, how shots were fired, tons of coal produced per pound of explosive used, and the average pounds of explosives per shot fired:—

District.	Quantity of Exlosives used in Pounds.	Tonnage of District.	No. of Shots fired by Electricity.	No. of Shots fired by Fuse.	Total No. of Shots fired.	Tons of Coal per Pound of Explosive.	Average Pounds of Explosive per Shot fired.
Vancouver Island	481,562	1,666,211	577,397	3,142	580,539	3.46	0.82
Nicola-Similkameen	35,793	179,179	48,585	450	49,035	5.00	0.72
East Kootenay	18,841	732,864	12,884	2,946	15,830	39.37	1.19
Northern District	.....	470	.....	.....	.....	.....	.....
Totals	536,196	2,578,725	638,866	6,538	645,404	4.82	0.83

The production of coal per pound of explosive used is 0.48 tons greater than that of the previous year.

The Crowsnest Pass District showed an increase of 1.01 tons per pound of explosive used, the yield being 39.37 tons, compared with 38.36 tons for 1917.

The Nicola-Princeton District showed a decrease of 0.64 ton per pound of explosive used, the yield being 5 tons, compared with 5.64 tons for 1917.

The Vancouver Island mines showed an increase of 0.15 ton per pound of explosive used, the yield being 3.46 tons, compared with 3.31 for 1917.

Machine-mined Coal.

During the year mining-machines produced 190,887 tons of coal, or 7.4 per cent. of the whole. This is a decrease under the figures of 1917, when the percentage of machine-mined coal was 10.94 per cent.

Of the total machine-mined coal, the Canadian Western Fuel Company produced 91,359 tons, or 47.86 per cent.; the Canadian Collieries (D.), Limited, 57,867 tons, or 30.32 per cent; the Princeton Coal and Land Company, 38,673 tons, or 20.26 per cent.; and the Crow's Nest Pass Coal Company, 2,988 tons, or 0.0156 per cent.

The following table gives the district, number of machines, how driven, tons of coal produced, and types of machines used:—

District.	No. driven by		Tons of Coal produced.		Total in Tons.
	Electricity.	Compressed Air.	Electricity.	Compressed Air.	
Nicola-Similkameen	..	5	.....	38,673	38,673
Vancouver Island	5	13	57,867	91,359	149,226
Crowsnest Pass	..	3	.....	2,988	2,988
Totals	5	21	57,867	133,020	190,887

Types of Machines in Use.

Type.	District.			Totals.
	Crowsnest Pass.	Nicola-Similkameen.	Vancouver Island.	
"Percussive" Post	3	5	8	16
"Bar" Longwall	..	..	5	5
"Chain" Longwall	..	..	5	5
Totals	3	5	18	26

Safety-lamps.

There were 4,364 safety-lamps in use in the coal-mines of the Province, an increase of 188 over the previous year. Of this number, 1,699 were flame-lamps of the Wolf type and 2,665 were electric lamps of various makes, an increase of 1,107 of this latter type of lamp during the year.

The following table shows the distribution of lamps by districts, methods of locking, and the illuminant used:—

District.	Magnetic.	Screw or Automatic Clip.	Naphtha.	Electricity.
East Kootenay	140	1,015	140	1,015
Nicola-Similkameen	168	125	168	125
Vancouver Island	1,391	1,525	1,391	1,525
Totals	1,699	2,665	1,699	2,665

Mine-air Sampling in Coal-mines.

During the year 510 mine-air samples were taken in the coal-mines of the Province. Of this number, thirty-nine samples were spoiled in transit, accidents in laboratory, or by reason of incomplete records.

Much valuable information has been obtained and added to that obtained in previous years relative to the flow of methane from the various coal-seams mined. A great deal of sampling has been done in the mines operated by the Crow's Nest Pass Coal Company to determine the gas-flow, and also to determine what bearing the breaking of coal has on the gas-flow of these mines. It is claimed by the officials of the Miners' Union and the men that the adoption of a single-shift system would lower the gas-flow in these mines. During the months of April, May, and June, 1917, when the mines were idle in the Crowsnest Pass District, mine-air samples were taken regularly each month to determine the gas-flow while no coal was being mined. The results obtained were astonishing; in some cases the flow of gas was as large at the end of seventy days as when the mine was working, proving that the outflow of gas does not depend on the breaking of the coal alone, but is constantly being given off by the exposed surface of the coal and strata.

During 1918 some very interesting results were obtained by sampling in the Crowsnest Pass mines during the idle period in September, and also by sampling every two hours during a working day of twenty-four hours and every half-hour during a working-shift of eight hours.

The following are percentages found in samples taken during idle period in September in No. 1 East mine, Coal Creek Colliery, and for nine days after starting to work again:—

South Side Split.—It is to be regretted that a sample was not taken in this split the day before the mines were closed down. One taken on August 9th, 2.34 per cent.; July 3rd, 1.82 per cent.; June 18th, 1.86 per cent.

Mine idle	45	hours	1.82	per cent. of methane.
„	67	„	1.77	„ „
„	71	„	1.80	„ „
„	115	„	1.64	„ „
„	119	„	1.70	„ „
„	121	„	1.68	„ „
„	141	„	1.54	„ „
„	165	„	1.55	„ „
„	9	days	1.57	„ „
„	9	„	1.52	„ „
„	10	„	1.33	„ „
„	12	„	1.73	„ „
„	13	„	1.61	„ „
„	14	„	1.62	„ „
„	15	„	1.64	„ „
„	16	„	1.63	„ „

Mine idle	17 days	1.65	per cent. of methane.
„	19 „	1.61	„ „
„	23 „	1.45	„ „
„	26 „	1.57	„ „
„	28 „	1.50	„ „
„	30 „	1.52	„ „
Mine working again	1 day	1.48	„ „
„ „	2 „	1.43	„ „
„ „	3 „	1.61	„ „
„ „	7 „	1.62	„ „
„ „	8 „	1.66	„ „
„ „	9 „	1.66	„ „

The following are percentages found in samples taken during the idle period in September in No. 1 South mine and for nine days after starting work again:—

Main return airway idle	10 days	1.24	per cent. of methane.
„ „	12 „	1.14	„ „
„ „	13 „	1.31	„ „
„ „	15 „	1.43	„ „
„ „	16 „	1.52	„ „
„ „	17 „	1.40	„ „
„ „	19 „	1.62	„ „
„ „	31 „	1.46	„ „
Main return airway working again	2 days	1.11	„ „
„ „ „	3 „	1.25	„ „
„ „ „	4 „	1.41	„ „
„ „ „	5 „	1.19	„ „
„ „ „	8 „	1.30	„ „
„ „ „	9 „	1.35	„ „

The chart on page 331 shows the quantity of air passing when the various tests were made. In No. 1 South mine there is an increase of 0.22 per cent. in twenty-one days with the mine idle, and the same quantity of air passing, and a decrease is shown when the mine is operating again during the first nine days with the same quantity of air passing.

The following are percentages found in samples taken in the last working-place on the South side split, No. 1 East mine, Coal Creek Colliery, every two hours during working-hours, from 9 a.m. until 7 a.m. on April 25th and 26th, 1918:—

9 a.m.	2.02	per cent. of methane.
11 „	2.14	„ „
1 p.m.	2.29	„ „
3 „	2.26	„ „
5 „	2.26	„ „
7 „	2.20	„ „
9 „	2.20	„ „
11 p.m. (spoiled).		
1 a.m.	2.21	„ „
3 „	2.21	„ „
5 „	2.13	„ „
7 „	2.08	„ „

The following are percentages found in samples taken every half-hour in No. 6 incline, No. 3 mine, Coal Creek Colliery, on June 1st, 1918:—

9.30 a.m.	0.79	per cent. of methane.
10.00 „	0.72	„ „
10.30 „	0.74	„ „
11.00 „	0.85	„ „
11.30 „	0.83	„ „
12.00 noon	0.86	„ „
12.30 p.m.	1.09	„ „
1.00 „	1.13	„ „

1.30	p.m.	1.25	per cent. of methane.
2.00	„	1.11	„ „
2.30	„	1.03	„ „
3.00	„	1.12	„ „
3.30	„	1.23	„ „

The following are percentages found in samples taken every half-hour in the same place on June 6th, 1918:—

9.30	a.m.	0.75	per cent. of methane.
10.00	„	0.88	„ „
10.30	„ (spoiled).		
11.00	„	1.03	„ „
11.30	„	1.11	„ „
12.00	noon	1.06	„ „
12.30	p.m.	1.16	„ „
1.00	„	1.14	„ „
1.30	„	1.26	„ „
2.00	„	1.29	„ „
2.30	„	1.26	„ „
3.00	„ (spoiled).		
3.30	„ (spoiled).		

From the results obtained it would appear that the breaking of coal has not much bearing on the gas-flow in these mines, and from the results shown in the returns from samples taken every two hours it is apparent that the conditions are not changed much by the working of two shifts, the maximum raise at any time during the twenty-four hours being less than $^{3}/_{10}$ of 1 per cent.; while samples taken every half-hour in No. 3 mine showed a maximum raise of a little over ½ per cent.

There is no doubt that a single shift inaugurated in some of the Crowsnest Pass mines would have very beneficial results on the dust conditions, and in any mine have beneficial results for the prevention of accidents due to other causes at the working-faces.

The following table shows the tabulated data obtained from the mine-air sampling in coal-mines during 1918:—

RETURNS FROM MINE-AIR SAMPLES TAKEN IN THE VARIOUS COAL-MINES OF THE PROVINCE OF BRITISH COLUMBIA DURING THE YEAR 1918.

Coast District.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or Idle.	Tonnage of Mine per Day.	Tonnage of Split per Day.	Chemical Analysis: CO_2.	Chemical Analysis: O.	Chemical Analysis: CH_4.	Chemical Analysis: N.	Velocity of Air in Feet per Minute.	Quantity of Air in Feet per Minute.	Barometer.	Hygrometer. Dry Bulb.	Hygrometer. Wet Bulb.	Hygrometer. Humidity.	Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Lb. of Methane per Day.	Cubic Feet of Methane per Ton of Coal mined.
82	Feb. 11	Extension No. 1	East side split	Working	170	120	0.34	20.47	0.06	79.13	185	11,100	29.1	55	55	100	6.0	8,640	378	72
96	Mar. 9	"	"	"	176	120	0.31	20.45	0.07	79.17	300	12,000	28.9	55	55	100	8.8	11,520	493	96
118	April 11	"	"	"	160	90	0.34	20.36	0.12	79.19	90	6,480	29.5	57	55	88	7.6	10,944	468	121
142	May 8	"	"	"	160	100	0.37	20.36	0.11	79.19	110	6,600	29.5	56	56	100	7.0	10,080	431	100
205	Nov. 19	"	"	"	175	120	0.36	20.39	0.12	79 23	100	4,800	29.5	57	56	93	5.7	8,208	351	68
83	Feb. 11	"	West side split	"	170	50	0.32	20.43	0.12	79.13	230	11,500	29.1	56	56	100	13.0	18,720	801	374
97	Mar. 9	"	"	"	176	56	0.34	20.42	0.19	79.05	250	12,500	28.9	54	53	93	23.0	33,120	1,417	591
119	April 11	"	"	"	160	70	0.30	20.40	0.16	79.14	180	9,720	29.5	56	55	93	15.4	22,176	949	316
143	May 9	"	"	"	160	60	0.26	20.37	0.19	79.18	120	6,600	29.5	54	54	100	12.0	17,280	739	288
206	Nov. 19	"	"	"	175	55	0.35	20.40	0.10	79.15	500	10,000	29.5	55	55	100	10.0	14,400	616	261
84	Feb. 11	"	Main return airway	"	170	....	0.33	20.45	0.07	79.15	570	31,350	29.1	54	54	100	21.0	30,240	1,294	177
98	Mar. 9	"	"	"	176	....	0.33	20.44	0.09	79.14	550	30,800	28.9	55	55	100	27.0	38,880	1,664	220
120	April 11	"	"	"	160	....	0.38	20.34	0.11	79.17	500	32,000	29.5	55	54	93	35.0	50,400	2,157	315
141	May 8	"	"	"	160	....	0.35	20.17	0.11	79.39	565	33,900	29.5	55	55	100	37.0	52,280	2,280	333
207	Nov. 19	"	"	"	175	....	0.36	20.35	0.09	79.20	600	27,000	29.5	56	56	100	24.0	34,560	1,479	197
78	Feb. 9	Extension No. 2	No. 2 East split	"	215	54	0.57	19.65	0.09	79.69	200	6,000	29.1	59	58	93	5.0	7,200	308	374
93	Mar. 8	"	"	"	274	71	0.48	19.84	0.08	79.60	220	6,600	28.8	58	58	100	5.0	7,200	308	101
114	April 11	"	"	"	300	85	0.52	19 61	0.14	79.73	300	7,500	29.5	58	58	100	10.5	15,120	647	177
144	May 8	"	"	"	290	84	0.59	19.44	0.17	79.80	250	6,750	29.5	60	60	100	11.0	15,840	677	188
208	Nov. 19	"	"	"	312	104	0.50	19.72	0.07	79.71	300	6,000	29.5	60	58	87	4.2	6,048	258	58
80	Feb. 9	"	No. 4 East split	"	215	78	0.44	20.16	0.03	79.37	300	13,500	29.1	58	56	87	4.0	5,760	246	73
94	Mar. 8	"	"	"	274	110	0.47	20.10	0.04	79.39	260	13,000	28.8	56	55	93	5.0	7,200	308	65
116	April 11	"	"	"	300	110	0.45	20.03	0.04	79.48	400	11,500	29.4	60	58	87	4.6	6,624	283	60
146	May 8	"	"	"	290	106	0.45	20.04	0.04	79.47	238	10,000	29.4	58	58	100	4.0	5,760	246	....
210	Nov. 19	"	"	"	312	118	0.34	20.25	.....	79.41	1,750	10,500	29.4	59	58	93	.....	.....	.....	.....
79	Feb. 9	"	West side split	"	215	83	0.52	19.64	0.29	79.55	250	10,000	29.1	65	65	100	29.0	41,760	1,787	503
92	Mar. 8	"	"	"	274	92	0.64	19.31	0.31	79.74	210	8,400	28.8	65	64	93	26.0	37,440	1,602	407
115	April 11	"	"	"	300	104	0.57	19.57	0.27	79.50	340	9,000	29.5	65	64	93	24.0	34,560	1,479	332
145	May 8	"	"	"	290	100	0.65	19.29	0.31	79.75	228	8,200	29.5	66	65	93	25.0	36,000	1,540	360
209	Nov. 19	"	"	"	312	90	0.46	19.94	0.05	79.55	430	27,090	29.4	59	58	93	13.0	18,720	801	208
81	Feb. 9	"	Main return airway	"	215	....	0.43	19.98	0.11	79.48	460	27,000	29.1	59	59	100	29.0	41,760	1,787	194
95	Mar. 8	"	"	"	274	...	0.38	20.05	0.10	79.47	470	28,200	28.8	57	57	100	28.0	40,320	1,725	147
117	April 11	"	"	"	300	...	0.40	20.01	0.11	79.48	500	27,500	29.5	57	57	100	30.0	43,200	1,848	144
147	May 8	"	"	"	290	....	0.39	20.05	0.10	79.46	470	43,000	29.4	58	58	100	43.0	61,920	2,650	213
201	Nov. 19	"	"	"	312	....	0.33	20.22	0.03	79.42	1,000	35,000	29.4	56	55	93	10.0	14,400	616	46
89	Mar. 7	Extension No. 3	No. 1 split	"	350	205	0.69	19.28	0.32	79.71	350	14,000	29.1	61	60	93	44.0	63,360	2,711	309
122	April 12	"	"	"	350	177	0.58	19.56	0.31	79.55	290	12,150	29.3	62	60	88	37.0	53,280	2,280	301
148	May 9	"	"	"	350	165	0.41	19.83	0.24	79.52	280	14,800	29.4	61	59	88	35.0	50,400	2,157	305
212	Nov. 19	"	"	"	350	200	0.42	19.81	0.23	79.54	270	13,500	29.4	61	60	93	31.0	44,640	1,910	223
75	Feb. 8	"	No. 2 split	"	350	145	0.15	20.49	0.20	79.16	260	10,400	29.2	59	58	93	20.0	28,800	1,232	198
90	Mar. 7	"	"	"	350	145	0.10	20.59	0.23	79.08	200	10,000	29.1	56	55	93	23.0	33,120	1,417	228
121	April 12	"	"	"	350	173	0.09	20.63	0.22	79.06	120	7,200	29.3	57	56	93	15.8	22,652	969	130
149	May 8	"	"	"	350	185	0.13	20.49	0.27	79.11	125	7,500	29.5	53	52	93	20.0	28,800	1,232	155
213	Nov. 19	"	"	"	350	150	0.07	20.67	0.18	79.08	200	10,000	29.4	59	58	93	18.0	25,920	1,109	172
77	Feb. 8	"	Main return airway	"	350	....	0.40	20.01	0.17	79.42	500	25,000	29.2	59	59	100	42.0	60,480	2,588	172
91	Mar. 7	"	"	"	350	....	0.41	20.05	0.18	79.36	550	27,500	29.1	59	59	100	49.0	70,560	3,019	201
123	April 12	"	"	"	350	....	0.36	20.13	0.19	79.32	520	20,800	29.1	59	58	93	39.0	56,160	2,403	160
150	May 8	"	"	"	350	...	0.39	19.89	0.21	79.51	510	20,400	29.4	60	59	93	42.0	60,480	2,588	172

214	Nov. 19	Extension No. 3	Main return airway	Working	350	....	0.35	20.11	0.11	79.43	250	30,000	29.4	60	59	93	33.0	47,520	2.033	135
205	Nov. 19	S. Wellington No. 5.	"	"	175	....	0.02	20.86	.....	79.12	900	64,000	30.1	47	47	100	.....	.....	.....	.....
85	Feb. 20	Comox No. 4	No. 1 slope	"	780	350	0.16	19.23	1.29	78.87	450	22,500	29.5	60	60	100	290.0	417,600	17,873	1,193
101	Mar. 18	"	"	"	800	350	0.73	18.99	1.63	78.65	400	20,000	29.8	60	60	100	326.0	469,440	20,092	1,341
127	April 20	"	"	"	750	350	0.69	19.09	1.50	78.72	420	21,000	30.4	61	61	100	315.0	453,600	19,414	1,296
158	May 28	"	"	"	800	350	0.68	19.15	1.49	78.68	430	19,350	30.1	61	61	100	287.0	413,280	17,688	1,181
162	July 21	"	"	Idle 40 hours	800	350	0.67	19.12	1.57	78.64	350	17,500	30.0	62	61	93	274.0	394,560	16,887	1,127
173	Aug. 30	"	"	Working	800	350	0.65	19.13	1.67	78.55	310	15,500	30.7	62	61	93	258.0	371,520	15,901	1,061
197	Nov. 6	"	"	"	800	350	0.55	19.37	1.50	78.58	315	15,750	30.1	61	61	100	235.0	338,400	14,483	967
220	Dec. 10	"	"	"	800	350	0.60	19.38	1.48	78.54	350	11,500	30 5	55	54	93	170.0	244,800	10,477	699
86	Feb. 23	"	East side, No. 2 slope	"	780	286	0.45	19.74	1.54	78.27	550	16,500	29.2	66	65	93	254.0	365,760	15,654	1,278
99	Mar. 18	"	"	"	800	300	0.45	20.15	1.83	77.57	725	32,625	29.9	65	65	100	596.0	858,240	36,732	2,860
124	April 20	"	"	"	800	250	0.43	19.67	1.59	78.31	760	27,360	30.5	65	65	100	434.0	624,960	26,748	2,499
156	May 28	"	"	"	800	250	0.44	19.50	1.76	78.30	900	27,000	30.2	67	67	100	475.0	684,000	29,275	2,736
160	July 21	"	"	Idle 40 hours	800	250	0.50	19.33	1.94	78.23	750	22,500	30.2	67	66	93	436.0	627,840	26,871	2,511
169	Aug. 30	"	"	Working	800	250	0.50	19.29	2.23	77.98	750	22,500	30.9	67	66	93	501.0	721,440	30,877	2,885
179	Oct. 2	"	"	"	800	250	0.58	19.23	2.27	77.92	725	21,750	30.1	69	68	94	492.0	708,480	30,322	2,834
221	Dec. 11	"	"	"	800	250	0.39	19.77	1.51	78 33	750	28,500	30.6	55	66	100	430.0	619,200	26,501	2,476
87	Feb. 23	"	West side, No. 2 slope	"	780	144	0.43	19.61	1.16	78.80	360	10,800	29.2	62	61	93	125.0	180,000	7,604	1,250
100	Mar. 18	"	"	"	800	150	0.29	20.03	0.75	78.93	440	13,200	30.0	64	60	76	99.0	142,560	6,101	950
125	April 20	"	"	"	800	150	0.34	19.89	0.93	78.84	620	15,500	30.6	65	62	76	144.0	207,360	8,875	1,382
157	May 28	"	"	"	800	200	0.27	19.90	1.07	78.76	750	15,000	30.2	65	63	88	160.0	230,400	9,871	1,152
161	July 21	"	"	Idle 40 hours	800	200	0.33	19.69	1.43	78.55	750	18,750	30.2	65	63	88	267.0	384,480	16,455	1,922
171	Aug. 30	"	"	Working	800	200	0.40	19.47	2.17	77.96	420	12,600	31.0	65	64	94	273.0	393,120	16,825	1,965
180	Oct. 2	"	"	"	800	200	0.34	19.57	1.88	78.21	310	13,020	30.2	64	63	93	244.0	351,360	15,038	1,756
196	Nov. 6	"	"	"	800	200	0.43	19.33	1.93	78.26	300	10,500	30.2	64	62	88	202.0	290,880	12,449	1,454
223	Dec. 11	"	"	"	800	200	0.62	18.99	2.34	78.05	400	10,800	30.7	64	62	88	252.0	362,880	15,531	1,814
88	Feb. 23	"	Main return airway	"	780	....	0.54	19.54	0.84	79.08	2,000	168,000	29.2	59	58	93	1,411.0	2,031,840	86,962	2,604
128	April 20	"	"	"	750	....	0.55	19.56	0.79	79.10	1,640	127,920	29.9	58	58	100	1,010.0	1,454,400	62,248	1,939
159	May 28	"	"	"	800	....	0.52	19.49	0.88	79 11	2,000	140,000	27.6	52	51	93	1,232.0	1,774,080	75,930	2,217
163	July 21	"	"	Idle 40 hours	800	....	0.64	19.19	1.10	79.07	1,600	136,000	29 8	52	61	93	1,496.0	2,154,240	92,201	2,692
168	Aug. 30	"	"	Working	800	....	0.69	19.07	1.28	78.96	1,430	107,250	30.2	61	60	93	1,372.0	1,975,680	84,559	2,469
182	Oct. 2	"	"	"	800	....	0.67	19.12	1.18	79.03	1,500	120,000	29.0	61	61	100	1,416.0	2,039,040	87,270	2,548
198	Nov. 8	"	"	"	800	....	0.62	19.36	0.95	79.07	1,460	131,400	29.5	59	59	100	1,248.0	1,797,120	76,916	2,246
224	Dec. 11	"	"	"	800	....	0.55	19.56	0.88	79.01	1,880	112,200	30.0	54	54	100	987.0	1,421,280	60,830	1,776
103	Mar. 19	Comox No. 5.	West side, No. 1 dip	"	750	100	0.08	20.64	0.42	78.86	1,950	11,700	29.4	51	50	93	49.0	70,560	3,019	750
136	April 23	"	"	"	850	100	0.06	20.65	0.51	78.98	2,425	14,550	29.6	50	50	100	45.0	64,800	2,773	648
154	May 27	"	"	"	900	100	0.08	20.67	0.19	79.06	575	25,875	29.8	50	49	93	49.0	70,560	3,019	705
177	Aug. 31	"	"	"	800	45	0.05	20.68	0.22	79.05	325	13,000	29.5	52	52	100	28.0	40,320	1,725	896
199	Nov. 8	"	"	"	800	45	0.05	20.76	0.18	79.01	270	11,340	29.8	51	51	100	20.0	28,800	1,232	640
104	Mar. 19	"	East side, No. 1 dip	"	750	250	0 08	20.65	0.41	78.86	240	17,280	29.4	52	51	93	70.0	100,800	4,314	403
137	April 24	"	"	"	850	300	0.10	20.54	0.58	78.78	235	18,330	29.6	52	51	93	106.0	152,640	6,532	508
153	May 27	"	"	"	900	350	0.09	20.56	0.52	78.83	210	15,120	29.8	53	53	100	78.0	112,320	4,807	320
176	Aug. 31	"	"	"	800	355	0.12	20.40	0.79	78.69	240	14,400	29.5	55	54	93	113.0	162,720	6,964	458
200	Nov. 8	"	"	"	800	355	0.11	20.48	0.49	78.94	400	22,400	29.8	54	54	100	105.0	151,200	6,471	425
105	Mar. 19	"	No. 1 dip and incline pillars	"	750	650	0.19	20.31	0.35	79.15	1,460	78,840	29.4	55	55	100	275.0	396,000	16,948	609
135	April 23	"	"	"	850	500	0.14	20.24	0.35	79.27	1,200	64,800	29.6	55	55	100	226.0	325,440	13,928	479
152	May 27	"	"	"	900	550	0.04	20.82	0.02	79.12	1,350	72,900	29.8	55	55	100	14.0	20,160	862	36
175	Aug. 31	"	"	"	800	550	0.15	20.21	0.35	79.29	1,385	69,250	29.4	57	56	93	242.0	348,480	14,904	630
201	Nov. 8	"	No. 2 dip	"	800	200	0.12	20.43	0.24	79.21	100	4,000	29.8	55	54	93	9.0	12,960	554	64
106	Mar. 19	"	West side of shaft	"	750	100	0.12	20.59	0.19	79.10	1,750	14,000	29.4	51	51	100	26.0	37,440	1,602	374
133	April 23	"	"	"	850	250	0.08	20.74	0.11	79.07	1,100	44,000	29.6	49	49	100	48.0	69,120	2,958	276
151	May 27	"	"	"	900	250	0.03	20.69	0.14	79.14	660	27,720	29.8	48	48	100	38.0	54,720	2,342	218
174	Aug. 31	"	"	"	800	250	0.06	20.68	0.12	79.14	1,250	50,000	29.4	52	51	93	60.0	86,400	3,697	344
202	Nov. 8	"	"	"	800	200	0.06	20.81	0.09	79.04	1,275	51,000	29.7	52	51	93	45.0	64,800	2,773	324
107	Mar. 19	"	Main return airway	"	750	....	0.13	20.51	0.23	79.13	1,500	180,000	29.2	51	51	100	414.0	596,160	25,515	794
134	April 23	"	"	"	850	....	0.10	20.52	0.21	79.17	1,430	110,160	29.6	51	51	100	231.0	332,640	14,236	391
178	Aug. 31	"	"	"	800	....	0.11	20.44	0.25	79.20	1,625	162,500	29.3	53	53	100	406.0	584,640	25,022	780
203	Nov. 8	"	"	"	800	...	0.08	20.57	0.17	79.31	2,000	180,000	29.6	53	53	100	306.0	440,640	18,859	550
108	Mar. 20	Comox No. 7.	West side split	"	286	195	0.17	20.53	0.29	79.01	245	7,350	30.1	54	53	93	21.0	30,240	1,294	155
129	April 22	"	"	"	300	200	6.12	20.49	0.29	79.10	475	11,400	29.9	54	54	100	33.0	47,520	2,033	237
164	July 22	"	"	"	320	143	0.12	20.46	0.25	79.17	425	8,500	29.8	55	55	100	21.0	30,240	1,294	211
216	Nov. 22	"	"	"	335	210	0.13	20.59	0.17	79.11	900	22,500	29.9	55	55	100	38.0	54,720	2,342	260

RETURNS FROM MINE-AIR SAMPLES TAKEN IN COAL-MINES—*Continued.*

Coast District—Concluded.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or Idle.	Tonnage of Mine per Day.	Tonnage of Split per Day.	Chemical Analysis. CO_2.	Chemical Analysis. O.	Chemical Analysis. CH_4.	Chemical Analysis. N.	Velocity of Air in Feet per Minute.	Quantity of Air in Feet per Minute.	Barometer.	Hygrometer. Dry Bulb.	Hygrometer. Wet Bulb.	Hygrometer. Humidity.	Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Lb. of Methane per Day.	Cubic Feet of Methane per Ton of Coal mined.
108	Mar. 20	Comox No. 7	No. 1 East	Working	286	38	0.09	20.76	0.08	79.07	Slack		29.8	49	49	100				
131	April 22	"	"	"	300	60	0.14	20.64	0.13	79.09	430	21,500	29.5	47	47	100	28.0	40,320	1,725	672
166	July 22	"	"	"	320	117	0.12	20.55	0.20	79.13	350	16,500	29.5	49	49	100	33.0	47,520	2,033	406
218	Nov. 22	"	"	"	335	65	0.10	20.71	0.10	79.09	500	22,500	29.7	49	49	100	22.0	31,680	1,355	487
130	April 22	"	No. 2 East	"	300	40	0.05	20.82	Trace.	79.13	280	8,400	29.9	49	48	93				
165	July 22	"	"	"	320	62	0.06	20.82	0.02	79.10	100	1,000	29.7	54	54	100	2.0	288	12	
217	Nov. 22	"	"	"	335	60	0.13	20.78	0.10	78.99	150	6,750	30.1	55	55	100	6.0	8,640	369	
110	Mar. 20	"	Main return airway	"	286		0.11	20.71	0.19	78.99	1,420	99,400	29.5	48	48	100	188.0	270,720	11,586	946
132	April 22	"	"	"	300		0.13	20.62	0.22	79.03	1,320	126,720	29.5	48	48	100	278.0	400,320	17,133	1,334
167	July 22	"	"	"	320		0.15	20.58	0.23	79.04	1,275	127,500	29.5	50	49	93	293.0	421,920	18,058	1,318
219	Nov. 22	"	"	"	335		0.15	20.67	0.18	79.00	2,100	126,000	29.7	43	43	100	226 0	325,440	13,928	971
80	Feb. 19	N. side No 1, Nanaimo	Newcastle return	"	780	310	0.29	20.35	0.23	79.13	400	16,000	30.2	58	57	93	36 0	51,840	2,218	167
92	Mar. 12	"	"	"	750	380	0.34	20.11	0.30	79.25	300	10,800	30.4	59	59	100	32.0	46,080	1,972	121
117	April 16	"	"	"	720	270	0.30	20.20	0.29	79.21	310	15,500	30.6	64	64	100	45.0	64,800	2,773	240
133	May 9	"	"	"	790	315	0.33	20.00	0.28	79.39	400	14,000	30.5	58	56	88	39.0	56,160	2,403	178
93	Mar. 12	"	Nos. 1 and 2 walls and inclined pillars	"	750	260	0.32	20.14	0.18	79.36	350	35,000	30.5	61	61	100	63.0	90,720	3,882	348
118	April 16	"	" "	"	720	410	0.36	20.10	0.24	79.30	360	36,000	30.8	61	61	100	86.0	123,840	5,300	302
134	May 9	"	" "	"	790	430	0.37	19.88	0.27	79.48	425	42,500	30.5	62	61	93	114.0	164,160	7,026	381
97	Mar. 13	"	Main return airway	"	800		0.34	20.13	0.18	79.35	1,260	50,400	31.1	58	57	93	90.0	129,600	5,546	162
116	April 16	"	"	"	720		0.34	20.18	0.16	79.32	1,300	45,500	30.6	58	57	93	72.0	103,680	4,437	144
137	May 9	"	"	"	745		0.33	20.13	0.17	79.37	1,150	33,500	30.5	58	58	100	56.0	80,640	3,451	108
66	Jan. 22	South side of No. 1	Sims dip	"	720	400	0.21	20.22	0.35	79.22	300	15,000	30.0	65	64	93	52.5	75,600	3,235	189
89	Feb. 25	"	"	"	550	300	0.19	20.14	0.41	79.26	300	12,000	30.2	65	64	93	49.0	70,560	3,019	235
96	Mar. 13	"	"	"	500	240	0.19	20.16	0.39	79.26	280	14,000	31.5	63	63	100	54.0	77,760	3,328	324
113	April 16	"	"	"	500	240	0.19	20.14	0.34	79.33	145	12,000	31.2	62	61	93	40.0	57,600	22,465	240
142	June 7	"	"	"	500	240	0.21	19.95	0.35	79.49	660	7,260	30.9	66	65	94	25.0	36,000	1,540	150
151	July 5	"	"	"	400	200	0.24	19.90	0.35	79.51	915	10,065	30.8	67	66	94	35.0	50,400	2,157	251
158	Aug. 22	"	"	"	700	60	0.20	20.05	0.21	79.54	625	9,375	31.1	67	66	94	19.0	27,360	1,171	456
67	Jan. 22	"	Farmer's section	"	720	320	0.29	19.67	0.80	79.24	300	18,000	30.0	60	60	100	144.0	207,360	8,875	648
90	Feb. 25	"	"	"	550	250	0.29	19.70	0.88	79.13	200	10,000	30.2	65	64	94	88.0	126,720	5,423	507
95	Mar. 13	"	"	"	500	260	0.27	19.86	0.76	79.11	80	5,120	31.5	63	63	100	38.0	54,720	2,342	210
112	April 16	"	"	"	500	260	0.31	19.79	0.83	79.07	150	9,500	31.2	62	61	93	78.0	112,320	4,807	432
143	June 7	"	"	"	500	260	0.22	19.75	0.83	79.20	80	4,000	30.9	65	64	94	33.0	47,520	2,033	182
150	July 5	"	"	"	400	200	0.28	19.82	0.72	79.18	100	5,000	30.8	65	65	100	36.0	51,840	2,218	259
157	Aug. 23	"	"	"	700	205	0.25	19.96	0.71	79.08	100	5,000	31.2	66	65	94	35.0	50,400	2,157	245
69	Jan. 22	"	Protection pillars, No. 6 South and Nos. 2 and 7 North	"		427	0.25	20.34	0.09	79.32	800	40,000	30.0	60	58	88	36.0	51,840	2,218	121
82	Feb. 19	"	Ditto	"		150	0.20	20.52	0.07	79.21	1,300	52,000	30.2	60	60	100	36.0	51,840	2,218	370
115	April 16	"	do	"		400	0.19	20.50	0.07	79.24	1,000	42,000	30.6	60	60	100	29.0	41,760	1,725	104
136	May 9	"	do	"		460	0.18	20.32	0.08	79.42	920	36,800	30.5	60	60	100	29.0	41,760	1,725	90
152	July 5	"	No. 2 South	"		90	0.34	20.03	0.18	79.45	1,125	5,000	30.3	65	64	94	9.0	12,960	554	144
159	Aug. 23	"	"	"		70	0.36	20.01	0.14	79.49	800	3,000	30.7	67	65	88	4.0	5,760	246	82
68	Jan. 22	"	Main return airway	"	720		0.35	19.95	0.39	79.33	800	42,500	30.0	60	60	100	165.0	237,600	10,169	330
91	Feb. 25	"	"	"	550		0.32	20.02	0.39	79.27	1,000	60,000	30.2	66	66	100	234.0	336,960	14,421	612
98	Mar. 13	"	"	"	500		0.31	20.08	0.34	79.27	770	46,200	31.1	62	62	100	157.0	226,080	9,676	452
114	April 16	"	"	"	500		0.33	20.04	0.35	79.28	745	41,160	30.6	62	62	100	143.0	205,920	8,813	411
145	June 7	"	"	"	500		0.36	20.05	0.33	79.36	600	33,000	30.4	64	64	100	108.0	155,520	6,656	311
153	July 5	"	"	"	800		0.30	20.00	0.32	79.38	700	38,500	30.3	65	65	100	123.0	177,120	7,580	221

160	Aug. 23	South side of No. 1	Main return airway	Working	700	....	0.30	20.07	0.29	79.34	500	27,500	30.7	65	64	94	79.0	113,760	4,868	162
70	Jan. 23	Reserve	No. 1 East split	"	520	140	0.09	20.72	0.09	79.10	370	18,500	30.3	57	55	88	16.0	23,040	986	164
83	Feb. 22	"	"	"	500	200	0.07	20.62	0.16	79.15	350	15,700	30.0	56	55	93	25.0	36,000	1,540	180
99	Mar. 14	"	"	"	500	180	0.07	20.65	0.10	79.18	430	19,350	31.5	56	55	93	19.0	27,360	1,171	152
121	April 17	"	"	"	460	160	0.07	20.68	0.09	79.16	330	16,500	31.6	57	56	93	14.0	20,160	862	126
162	Aug. 28	"	"	"	350	100	0.08	20.57	0.11	79.24	200	10,000	31.1	63	61	88	11.0	15,840	677	158
71	Jan. 23	"	No. 2 East split	"	520	110	0.08	20.69	0.04	79.19	300	18,000	30.3	57	55	88	7.0	10,080	431	91
84	Feb. 22	"	"	"	500	100	0.11	20.60	0.04	79.25	350	10,500	30.0	57	55	88	4.0	5,760	246	57
100	Mar. 14	"	"	"	500	20	0.11	20.57	0.04	79.28	145	2,900	31.5	56	55	93	1.0	1,440	61	72
72	Jan. 23	"	No. 3 East split	"	520	60	0.06	20.84	0.02	79.08	300	15,000	30.0	54	52	86	3.0	4,320	184	72
85	Feb. 22	"	"	"	500	....	0.05	20.84	0.03	79.08	500	20,000	30.0	55	53	86	6.0	8,640	369	.....
73	Jan. 23	"	No. 1 West split	"	520	270	0.10	20.69	0.15	79.06	500	30,000	30.3	56	55	93	45.0	64,800	2,773	240
86	Feb. 22	"	"	"	500	200	0.08	20.67	0.15	79.10	500	25,000	30.0	55	54	93	37.0	53,280	2,280	266
101	Mar. 14	"	"	"	500	50	0.05	20.81	0.04	79.10	190	9,500	31.3	57	56	93	3.0	4,320	184	86
122	April 17	"	"	"	460	60	0.16	20.78	0.05	79.01	150	6,750	31.5	56	54	88	3.0	4,320	184	72
163	Aug. 28	"	"	"	350	150	0.06	20.77	0.09	79.08	780	19,500	31.1	60	59	93	17.0	24,480	1,047	163
102	Mar. 14	"	No. 2 West split	"	500	250	0.07	20.66	0.19	79.08	470	26,320	31.1	56	54	88	50.0	72,000	3,081	288
123	April 17	"	"	"	460	240	0.09	20.66	0.18	79.07	460	23,000	31.5	56	54	88	41.0	59,040	2,526	246
164	Aug. 28	"	"	"	350	100	0.06	20.66	0.22	79.06	380	15,200	31.1	55	54	93	33.0	47,520	2,033	475
74	Jan. 23	"	Main return airway	"	520	....	0.06	20.64	0.14	79.16	800	80,000	30.0	56	54	88	112.0	161,280	6,902	310
87	Feb. 22	"	"	"	500	....	0.07	20.65	0.14	79.14	1,000	70,000	30.0	53	53	100	98.0	141,120	6,049	282
103	Mar. 14	"	"	"	500	....	0.06	20.70	0.13	79.11	1,060	84,800	31.3	55	54	93	110.0	158,400	6,779	317
124	April 17	"	"	"	460	....	0.10	20.72	0.13	79.05	760	60,800	31.5	56	55	93	79.0	113,760	4,868	247
165	Aug. 28	"	"	"	350	....	0.06	20.64	0.14	79.16	800	72,000	31.1	57	56	93	100.0	144,000	6,163	411
76	Jan. 30	Harewood	No. 1 split	"	630	150	0.06	20.76	Trace.	79.18	200	8,000	29.1	50	48	86	.....	.....	.....	.....
125	April 18	"	"	"	735	441	0.13	20.81	0.03	79.03	210	10,500	30.2	48	48	100	3.0	4,320	184	9
77	Jan. 30	"	No. 2 split	"	630	480	0.07	20.78	Trace.	79.15	250	13,000	29.1	50	48	86	.....	.....	.....	.....
106	Mar. 15	"	"	"	750	550	0.05	20.83	Trace.	79.12	330	18,480	29.9	52	51	93	.....	.....	.....	.....
126	April 18	"	"	"	735	147	0.09	20.73	0.02	79.16	80	4,000	30.2	50	50	100	8.0	1,152	49	7
127	April 18	"	No. 3 split	"	735	45	0.05	20.70	0.02	79.23	1,650	6,750	30.2	48	47	93	1.0	1,440	64	32
128	April 18	"	No. 4 split	"	735	102	0.09	20.82	0.03	79.06	90	5,400	30.2	49	49	100	1.0	1,440	64	14
78	Jan. 30	"	Main return airway	"	630	....	0.06	20.84	Trace.	79.10	450	22,500	29.1	48	48	100	.....	.....	.....	.....
108	Mar. 15	"	"	"	750	....	0.05	20.82	Trace.	79.13	350	22,050	29.9	48	47	93	.....	.....	.....	.....
129	April 18	"	"	"	735	....	0.08	20.78	0.03	79.11	300	18,000	30.2	51	49	88	5.0	7,200	308	9
109	April 11	Morden	Left side split	"	350	250	0.06	20.62	0.78	78.54	300	18,000	30.7	53	52	93	140.0	201,600	8,628	806
130	May 7	"	"	"	400	200	0.05	20.67	0.55	78.73	730	26,280	30.6	59	58	93	144.0	207,360	8,875	1,036
138	June 6	"	"	"	400	200	0.05	20.60	0.58	78.77	750	19,500	30.6	55	55	100	113.0	162,720	6,964	813
147	July 4	"	"	"	400	130	0.05	20.62	0.54	78.79	725	25,375	30.6	57	56	93	136.0	195,840	8,381	1,506
154	Aug. 22	"	"	Idle 16 hours	275	115	0.07	20.62	0.62	78.73	525	18,900	30.8	57	56	98	117.0	168,480	7,210	1,465
166	Nov. 19	"	"	Working	150	40	0.04	20.73	0.39	78.84	620	24,800	30.8	55	54	93	96.0	138,240	5,916	3,456
110	April 11	"	Right side split	"	350	100	0.05	20.78	0.34	78.83	2,300	13,800	30.7	53	52	93	46.0	66,240	2,835	662
131	May 7	"	"	"	400	200	0.04	20.66	0.51	78.79	790	17,400	30.6	53	53	100	88.0	126,720	5,423	633
139	June 6	"	"	"	400	200	0.06	20.60	0.49	78.85	900	22,500	30.7	55	54	93	110.0	158,400	6,779	792
148	July 4	"	"	Idle 16 hours	400	270	0.06	20.68	0.40	78.86	950	14,250	30.7	56	56	100	56.0	80,640	3,451	295
155	Aug. 22	"	"	Working	275	160	0.05	20.67	0.44	78.84	200	15,600	31.0	59	58	93	68.0	97,920	4,190	612
167	Nov. 19	"	"	"	150	110	0.04	20.82	0.25	78.89	300	21,000	30.9	57	56	93	52.0	74,880	3,204	680
75	Jan. 29	"	Main ret rn airway	"	400	....	0.08	20.61	0.55	78.76	800	64,000	29.8	52	50	86	352.0	506,880	21,694	1,267
105	Mar. 14	"	"	"	400	...	0.05	20.71	0.45	78.79	640	51,200	31.1	52	51	93	230 0	331,200	14,175	828
111	April 11	"	"	"	250	....	0.05	20.69	0.40	78.86	650	45,500	30.6	52	51	93	182.0	262,080	11,217	748
132	May 7	"	"	"	400	....	0.03	20.65	0.46	78.86	870	60,000	30.6	52	52	100	276.0	397,440	17,010	993
140	June 6	"	"	"	400	....	0.05	20.63	0.43	78.89	620	37,200	30.6	54	53	93	160.0	230,400	9,861	576
149	July 4	"	"	Idle 16 hours	400	....	0.07	20.60	0.43	78.90	800	40,000	30.6	54	54	100	172.0	347,680	10,600	619
156	Aug. 22	"	"	Working	275	....	0.08	20.64	0.47	78.81	520	23,400	30.8	56	56	100	110.0	158,400	6,779	576
168	Nov. 19	"	"	"	150	....	0.05	20.75	0.29	78.91	900	43,200	30.8	54	53	93	125.0	180,000	7,704	1,200
119	April 16	Grant	East split	"	110	110	0.13	20.73	0.13	79.01	500	11,000	30.2	54	54	100	14.0	20,160	862	183
120	April 16	"	Main return airway	"	110	110	0.03	20.78	0.07	79.12	500	15,000	30.2	55	55	100	10.0	14,400	616	130
169	Nov. 20	"	"	"	100	110	0.03	20.84	0.05	79.08	130	10,400	30.4	55	54	93	5.0	7,200	308	72
170	Nov. 20	E. Wellington No. 1	"	"	120	110	0.04	20.77	0.08	79.11	700	15,500	30.7	57	57	100	12.0	17,280	739	144

RETURNS FROM MINE-AIR SAMPLES TAKEN IN COAL-MINES—*Continued.*

Nicola-Similkameen District.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or Idle.	Tonnage of Mine per Day.	Tonnage of Split per Day.	Chemical Analysis. CO_2.	O.	CH_4.	N.	Velocity of Air in Feet per Minute.	Quantity of Air in Feet per Minute.	Barometer.	Hygrometer. Dry Bulb.	Wet Bulb.	Humidity.	Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Lb. of Methane per Day.	Cubic Feet of Methane per Ton of Coal mined.
35	April 5	Princeton No. 1	Main return airway	Working	140	....	0.16	20.35	0.23	79.26	700	30,000	27.7	....	....	....	69.0	99,360	3,825	709
39	May 16	"	"	"	125	....	0.18	20.44	0.17	79.21	510	20,400	27.8	....	....	....	34.0	48,960	1,884	391
47	Aug. 20	"	"	"	140	....	0.20	20.34	0.28	79.18	600	21,600	28.3	58	57	93	60.0	86,400	3,326	617
48	Aug. 21	Coalmont No. 2	"	"	30	....	0.03	20.77	.....	79.20	Slack.	No veloc	26.2	55	55	100	.....	.....	.....	.....
36	April 6	Coal Hill No. 3	"	"	135	....	0.06	20.77	Trace	79.17	265	16,695	27.6	48	47	93	.....	.....	.....	.....
38	May 14	"	"	"	150	....	0.15	20.48	"	79.37	335	11,725	26.9	....	....	....	.....	.....	.....	.....
54	Aug. 23	"	"	"	160	....	0.11	20.75	0.03	79.11	1,640	41,000	27.7	54	54	100	12.0	17,280	665	108
51	Aug. 23	"	Split of No. 5 seam	"	160	55	0.11	20.62	0 02	79.25	350	1,400	27.7	53	53	100	0.28	403	15	7
53	Aug. 23	"	Split of No. 3 seam	"	160	105	0.12	20.68	0.04	79.16	340	23,800	27.7	52	52	100	9.0	12,960	488	123
34	April 4	Middlesboro No. 4 E.	Main return airway	"	125	....	0.06	20.78	0.03	79.13	430	24,800	27.7	....	....	...	7.0	10,080	388	80
40	May 7	"	"	"	125	....	0.09	20.68	0.12	79.11	800	20,000	28.0	....	....	....	24.0	34,560	1,330	276
57	Aug. 23	"	"	"	100	....	0.07	20.76	0.12	79.05	600	33,600	28.1	64	59	72	40.0	57,600	2,217	576
33	April 4	Middlesboro No. 4	Incline district	"	80	80	0.20	20.44	0.08	79.28	190	10,400	27.5	....	....	....	8.0	11,520	443	144
55	Aug. 23	"	"	"	110	...	0.18	20.48	0.05	79.29	200	10,000	27.8	59	58	93	5.0	7,200	277	65
56	Aug. 23	"	No. 6 district	"	110	30	0.09	20.72	0.07	79.12	300	9,000	27.8	55	53	87	6.0	8,640	332	288
32	April 4	Middlesboro No. 7	Main return airway	"	160	...	0.09	20.70	0.13	79.08	650	26,000	27.4	55	54	93	33.0	47,520	1,829	297
42	May 17	"	"	"	140	....	0.13	20.51	0.28	79.08	500	25,000	27.5	....	....	....	70.0	100,800	3,880	720
49	Aug. 22	"	"	"	130	....	0.19	20.26	0.34	79.21	600	30,060	27.8	59	57	88	102.0	146,880	5,654	1,129
50	Aug. 22	Middlesboro No. 8	"	Idle 7 days.	15	....	0.04	20.77	0.03	79.16	100	1,500	27.7	54	52	86	0.45	648	24	43

Crowsnest Pass District.

158	Jan. 23	No. 1 North	Main return airway	Working	150	....	0.17	20.57	0.45	78.81	170	11,900	25.8	58	57	93	53.0	76,320	2,831	508
168	Feb. 8	"	"	"	190	....	0.15	20.54	0.47	78.84	130	9,750	25.5	58	57	93	45.0	64,800	2,404	341
192	Mar. 21	"	"	"	200	....	0.21	20.47	0.64	78.68	280	16,800	25 6	56	56	100	107.0	154,080	5,716	780
193	April 10	"	"	"	250	....	0.18	20 50	0.57	78.75	150	12,000	25.8	58	58	100	68.0	97,920	3,632	391
244	May 23	"	"	"	220	....	0.20	20.41	0.50	78.89	320	16,000	25.5	58	58	100	80.0	115,200	4,273	523
316	Aug. 14	"	"	"	240	....	0.26	20,33	0.60	78.81	230	13,000	25.7	60	60	100	78.0	112,320	4,667	468
391	Nov. 4	"	"	"	200	....	0.22	20.45	0.36	78.97	240	14,400	25.4	58	57	93	51.0	73,440	2,724	367
162	Jan. 24	No. 1 South	"	"	500	....	0.14	20.18	1.92	77.76	400	30,000	24.9	51	49	88	576.0	829,440	30,772	1,658
176	Feb. 15	"	"	"	500	....	0.11	20.43	1.26	78.20	400	30,000	26.0	49	48	93	378.0	544,320	20,194	1,088
180	Mar. 8	"	"	"	550	....	0 15	20.17	2.10	77.58	480	36,000	25.6	48	47	92	756.0	1,088,640	40,388	1,979
205	April 18	"	"	"	550	....	0.15	20.27	1.69	77.89	550	35,750	25.8	50	49	93	603.0	868,320	32,214	1,578
234	May 4	"	"	"	550	....	0.11	20.13	1.95	77.81	520	33,800	25.0	51	50	93	659.0	948,960	35,207	1,725
290	July 5	"	"	"	550	....	0.19	19.99	2.28	77.54	575	37,375	25.5	55	54	93	850.0	1,224,000	45,410	2,225
321	Aug. 22	"	"	"	550	....	0.21	19.93	2.44	77.42	560	36,400	25.7	61	60	93	888.0	1,278,720	47,440	2,324
373	Oct. 9	No. 1 South *	"	"	550	....	0.21	20.23	1.11	78.45	600	39,000	....	....	....	...	432.0	622,080	23,079	1,203
373	Oct. 10	"	"	"	343	....	0.25	20.16	1.25	78.34	600	39,000	26.0	....	....	....	487.0	701,280	26,917	2,044
378	Oct. 11	"	"	"	365	....	0.21	20.13	1.41	78.25	600	39,000	26.0	....	....	....	549.0	790,560	29,329	2,165
381	Oct. 12	"	"	"	326	....	0.17	20.22	1.19	78.42	600	39,000	26.0	....	....	....	464.0	668,160	24,788	2,049
383	Oct. 15	"	"	"	400	....	0.21	20.16	1.30	78.33	600	39,000	25.9	....	....	....	507.0	730,080	27,085	1,825

* Recommenced after being idle 35 days.

385	Oct.	16	No. 1 South	Main return airway	Working	400		0.22	20.12	1.35	78.31	600	39,000	26.0				526.0	757,440	28,105	1,893
395	Nov.	5	"	"	"	400		0.19	20.26	1.00	78.55	600	39,000	25.2				390.0	561,600	20,835	1,404
439	Dec.	19	"	"	"	305		0.21	20.17	1.04	78.58	600	39,000	25.6				405.0	583,200	21,636	1,912
442	Dec.	21	"	"	"	360		0.20	20.21	1.05	78.54	600	39,000	26.2				409.0	588,960	21,850	1,636
320	Aug.	22	"	Main level split	"	550	275	0.15	20.24	1.78	77.83	250	23,750	25.7	56	55	93	421.0	606,240	22,491	2,204
443	Dec.	24	"	"	"	303		0.17	20.32	0.89	78.62	600	39,000	26.2				347.0	499,680	18,538	1,649
161	Jan.	24	"	"	"	500	150	0.06	20.52	1.00	78.42	300	27,000	24.9	44	42	84	270.0	388,800	14,424	2,592
179	Mar.	8	"	"	"	550	275	0.09	20.37	1.78	77.76	340	27,200	25.6	42	41	92	484.0	696,960	25,857	2,534
204	April	18	"	"	"	550	300	0.09	20.41	1.46	78.04	380	27,300	25.8	45	44	93	398.0	573,120	21,262	1,910
233	May	4	"	"	"	550	275	0.09	20.33	1.67	77.91	470	32,900	25.0	49	47	85	549.0	790,560	29,329	2,874
289	July	5	"	"	"	550	275	0.12	20.22	1.93	77.73	400	28,000	25.5	58	57	93	540.0	777,600	28,848	2,827
153	Jan.	11	No. 1 East	South side split	"	620	260	0.11	20.27	2.54	77.08	320	25,000	26.4	47	46	92	635.0	914,400	33,924	3,516
170	Feb.	11	"	"	"	550	200	0.09	20.37	1.96	77.58	500	37,500	25.8	45	43	85	735.0	1,058,400	39,266	5,292
183	Mar.	9	"	"	"	600	200	0.10	20.33	2.17	77.40	540	40,500	25.7	44	42	84	878.0	1,264,320	46,906	6,321
198	April	12	"	"	"	600	200	0.10	20.20	2.30	77.40	550	42,000	26.0	46	45	93	966.0	1,391,040	51,607	6,955
241	May	7	"	"	"	500	200	0.11	20.27	2.55	77.07	410	31,570	26.0	52	49	80	803.0	1,156,320	42,899	5,781
287	June	18	"	"	Idle 70 hours	480	180	0.10	20.32	1.94	77.64	500	37,500	26.0	52	51	93	727.0	1,046,880	38,839	5,816
301	July	23	"	"	Working	500	200	0.09	20.26	1.82	77.83	550	38,500	25.9	57	55	88	700.0	1,008,000	37,396	5,040
313	Aug.	9	"	"	"	500	200	0.11	20.20	2.34	77.35	520	36,400	25.8	56	55	93	851.0	1,225,440	45,464	6,127
364	Oct.	4	"	"	Idle 30 days			0.11	20.37	1.52	78.00	440	30,800	26.0	56	55	93	468.0	673,920	25,002	
377	Oct.	11	"	"	Working	396	150	0.13	20.39	1.61	77.87	470	32,900	26.0				529.0	761,760	28,261	5,078
382	Oct.	15	"	"	"	350	150	0.10	20.41	1.62	77.87	470	32,900	25.9				532.0	766,080	28,421	5,107
386	Oct.	17	"	"	"	360	140	0.13	20.38	1.64	77.85	460	32,200	26.0				528.0	774,720	28,742	5,533
418	Dec.	7	"	"	"	400	150	0.13	20.27	2.31	77.29	470	32,900	25.7				759.0	1,092,960	40,548	7,286
169	Feb.	11	"	North side split	"	550	350	0.06	20.62	0.79	78.53	260	36,400	25.8	43	42	92	287.0	413,280	15,332	1,180
182	Mar.	9	"	"	"	600	400	0.09	20.52	1.23	78.16	300	30,000	25.7	43	42	92	369.0	531,360	19,713	1,328
197	April	12	"	"	"	600	400	0.07	20.50	1.47	77.96	240	28,800	26.0	47	47	100	423.0	609,120	22,598	1,522
242	May	7	"	"	"	500	300	0.10	20.39	1.68	77.83	375	30,000	26.0	52	50	86	504.0	725,760	26,925	2,419
285	June	18	"	"	Idle 64 hours	480	360	0.10	20.40	1.45	78.05	325	30,000	26.1	52	50	86	435.0	626,400	23,239	2,088
302	July	23	"	"	Working	500	300	0.12	20.33	1.53	78.02	300	30,000	25.9	56	55	93	459.0	660,960	24,521	2,203
314	Aug.	9	"	"	"	500	200	0.15	20.29	1.46	78.10	580	29,000	25.8	56	55	93	423.0	609,120	22,598	2,030
340	Sept.	13	"	"	Idle 9 days			0.08	20.53	0.93	78.46	350	25,000	26.1	56	55	93	232.0	334,080	12,398	
387	Oct.	23	"	"	Working	300	180	0.11	20.41	1.28	78.20	420	31,500	25.7	56	55	93	403.0	580,320	21,529	3,224
419	Dec.	7	"	"	"	400	250	0.14	20.33	1.91	77.62	370	33,300	25.7	56	55	93	636.0	915,840	33,975	3,663
163	Jan.	24	"	Main return airway	"	600		0.12	20.41	1.28	78.19	1,120	120,960	25.7	49	48	93	1,547.0	2,227,680	72,646	3,712
184	Mar.	9	"	"	"	600		0.14	20.41	1.26	78.19	1,300	140,000	25.7	48	47	93	1,764.0	2,540,160	94,239	4,233
199	April	12	"	"	"	600		0.13	20.40	1.38	78.09	1,200	129,600	26.0	49	48	93	1,788.0	2,574,720	95,522	4,291
243	May	7	"	"	"	500		0.11	20.39	1.16	78.34	1,330	143,640	26.0	52	50	86	1,665.0	2,397,600	88,950	4,795
303	July	23	"	"	"	500		0.16	20.23	1.27	78.34	1,300	140,000	25.9	56	55	93	1,778.0	2,560,320	94,987	5,120
315	Aug.	9	"	"	"	500		0.12	20.24	2.01	77.63	1,300	140,400	25.8	56	55	93	2,822.0	4,063,680	150,762	8,127
341	Sept.	13	"	"	Idle 9 days			0.15	20.41	0.98	78.46	1,200	144,000	26.1	55	54	93	1,411.0	2,031,840	75,381	
388	Oct.	23	"	"	Working	300		0.17	20.31	1.09	78.44	1,300	140,400	25.7	56	55	93	1,530.0	2,203,200	81,738	7,344
389	Nov.	2	"	"	"	300		0.06	20.34	1.78	77.82	1,100	118,000	26.0	55	54	93	2,100.0	3,024,000	112,190	10,080
420	Dec.	7	"	"	"	400		0.14	20.39	1.05	78.42	1,400	151,300	25.7				1,588.0	2,286,720	84,837	5,716
174	Feb.	12	"B"	Incline split	"	275	50	0.10	20.60	1.08	78.22	230	13,896	25.5	52	49	80	149.0	214,560	7,960	4,291
187	Mar.	9	"	"	"	300	150	0.14	20.36	2.00	77.50	210	12,600	25.7	52	51	93	252.0	362,880	13,462	2,419
196	April	11	"	"	"	250	80	0.13	20.37	1.88	77.62	270	13,500	25.8	50	49	93	253.0	364,320	13,516	4,554
238	May	7	"	"	"	250	100	0.10	20.42	1.59	77.89	300	18,000	25.8	50	49	93	286.0	411,840	15,279	4,118
282	June	13	"	"	"	250	64	0.14	20.32	1.57	77.87	180	12,600	25.6	51	50	93	200.0	288,000	10,684	4,500
305	July	29	"	"	"	250	50	0.12	20.43	1.46	77.99	150	9,000	25.8	51	51	100	131.0	188,640	6,998	3,772
318	Aug.	14	"	"	"	250	100	0.15	20.34	1.65	77.86	150	12,000	25.5	52	52	100	198.0	255,120	10,577	2,851
365	Oct.	5	"	"	Idle 31 days			0.12	20.49	1.30	78.09	150	14,000	25.8				182.0	262,080	9,723	
400	Nov.	6	"	"	Working	250	100	0.13	20.45	1.26	78.16	450	18,000	25.7	47	46	93	226.0	325,440	12,073	3,254
155	Jan.	22	"	Side split	"	275	150	0.13	20.56	1.22	78.09	150	9,000	25.9	52	50	90	109.0	156,960	5,823	1,046
173	Feb.	12	"	"	"	275	225	0.19	20.22	2.52	77.07	300	10,800	25.5	51	50	93	272.0	391,680	14,531	1,740
186	Mar.	9	"	"	"	300	150	0.11	20.51	1.45	77.93	1,250	7,500	25.7	44	42	88	108.0	155,520	5,769	1,036
239	May	7	"	"	"	250	150	0.14	20.45	1.38	78.03	400	20,000	25.8	48	47	92	276.0	297,440	14,745	2,649
281	June	13	"	"	"	250	150	0.16	20.41	1.44	77.99	300	13,500	25.6	53	52	93	194.0	279,360	10,364	1,862
304	July	24	"	"	"	250	200	0.17	20 38	1.54	77.91	220	11,000	25.8	50	50	100	169.0	243,360	9,028	1,166
317	Aug.	16	"	"	"	250	150	0.14	20.43	1.35	78.08	300	15,000	25.5	55	55	100	202.0	290,880	10,791	1,939
366	Oct.	5	"	"	Idle 31 days			0.15	20.53	0.85	78.47	300	16,000	25.8				136.0	295,840	7,265	
399	Nov.	6	"	"	Working	250	150	0.10	20.62	0.68	78.60	280	14,000	25.7	50	49	93	95.0	136,800	5,075	912
172	Feb.	12	"	Main return airway	"	275		0.09	20.53	1.38	78.00	1,000	36,000	25.5	51	50	93	496.0	714,240	26,498	2,597

RETURNS FROM MINE-AIR SAMPLES TAKEN IN COAL-MINES—*Continued.*

Crowsnest Pass District—Concluded.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or Idle.	Tonnage of Mine per Day.	Tonnage of Split per Day.	Chemical Analysis. CO_2.	O.	CH_4.	N.	Velocity of Air in Feet per Minute.	Quantity of Air in Feet per Minute.	Barometer.	Hygrometer. Dry Bulb.	Wet Bulb.	Humidity.	Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Lb. of Methane per Day.	Cubic Feet of Methane per Ton of Coal mined.
185	Mar. 9	"B"	Main return airway	Working	300	....	0.14	20.42	1.55	77.89	520	37,800	25.7	51	49	86	586.0	843,840	31,306	2,812
200	April 12	"	"	"	250	....	0.16	20.46	1.40	77.98	640	35,200	25.8	49	49	100	492.0	708,480	26,284	2,834
240	May 7	"	"	"	250	....	0.11	20.45	1.21	78.23	770	41,540	25.8	32	31	87	502.0	722,380	26,818	2,891
280	June 13	"	"	"	250	....	0.15	20.43	1.21	78.21	630	34,020	25.6	52	51	93	411.0	591,840	21,957	2,367
306	July 24	"	"	"	250	....	0.15	20.39	1.34	78.12	600	30,000	25.9	47	46	93	402.0	578,880	21,476	2,315
319	Aug. 16	"	"	"	250	....	0.15	20.41	1.22	78.22	600	34,400	25.5	51	51	100	419.0	603,360	22,384	2,413
160	Jan. 24	No. 2	High line split	"	225	40	0.05	20.71	0.43	78.81	280	7,560	24.9	41	38	77	32.0	46,080	1,709	1,152
166	Feb. 7	"	"	"	230	30	0.06	20.77	0.30	78.77	200	6,000	25.7	37	37	100	18.0	25,920	961	864
188	Mar. 21	"	"	"	300	50	0.05	20.69	0.54	78.72	220	5,900	25.6	38	38	100	32.0	46,080	1,709	921
202	April 17	"	"	"	250	50	0.06	20.75	0.49	78.70	270	6,700	26.2	40	39	93	32.0	46,080	1,709	921
278	June 12	"	"	"	220	24	0.15	20.48	0.72	78.65	100	8,000	26.2	55	54	93	57.0	82,080	3,045	3,420
294	July 12	"	"	"	165	15	0.32	20.26	0.72	78.70	100	8,000	26.0	52	52	100	57.0	82,080	3,045	5,472
308	Aug. 2	"	"	"	200	15	0.08	20.66	0.44	78.82	100	6,000	25.9	55	54	93	26.0	37,440	1,389	2,496
388	Oct. 5	"	"	Idle 31 days	.....	....	0.15	20.58	0.60	78.67	80	6,400	25.8	....	....	....	38.0	54,720	2,030	.....
396	Nov. 5	"	"	Working	200	15	0.08	20.65	0.42	78.85	Slack.	Slack.	25.2	49	47	87	.....	.....	.....	.....
165	Feb. 7	"	Rock Tunnel split	"	230	200	0.19	20.34	1.15	78.32	130	11,700	25.7	59	59	100	134.0	192,960	7,158	964
191	Mar. 21	"	"	"	300	250	0.12	20.56	0.57	78.75	200	14,000	25.9	57	57	100	80.0	115,200	4,275	461
201	April 17	"	"	"	250	200	0.12	20.46	0.75	78.67	240	16,800	26.2	58	58	100	126.0	181,440	6,731	907
279	June 12	"	"	"	220	196	0.16	20.38	0.96	78.50	120	12,000	26.2	59	58	93	115.0	165,600	6,143	844
293	July 12	"	"	"	165	150	0.18	20.37	0.94	78.51	120	12,640	26.0	58	58	100	118.0	169,920	6,304	1,132
309	Aug. 2	"	"	"	200	185	0.19	20.17	1.24	78.40	100	10,000	25.9	60	59	93	124.0	178,560	6,624	964
344	Sept. 14	"	"	Idle 10 days	.....	....	0.22	20.17	1.44	78.17	140	14,000	26.2	....	....	....	201.0	289,440	10,739	....
398	Nov. 5	"	"	Working	200	185	0.17	20.36	0.88	78.59	100	10,800	25.7	50	50	100	95.0	136,800	5,075	738
412	Dec. 2	"	"	"	212	180	0.24	20.30	1.08	78.38	190	10,800	25.5	....	....	....	116.0	167,040	6,197	928
167	Feb. 7	"	Main return airway	"	230	....	0.26	20.32	0.69	78.73	650	37,700	25.8	56	56	100	260.0	374,400	13,890	1,627
203	April 17	"	"	"	250	....	0.24	20.39	0.66	78.71	600	34,800	26.2	56	56	100	229.0	329,760	12,234	1,319
277	June 22	"	"	"	220	....	0.24	20.27	0.72	78.77	630	36,540	26.2	57	56	93	262.0	377,280	13,997	1,714
295	July 12	"	"	"	165	....	0.26	20.28	0.68	78.78	640	37,320	26.0	59	58	93	253.0	364,320	13,516	2,208
307	Aug. 2	"	"	"	200	....	0.30	20.20	0.76	78.74	670	37,520	25.9	59	58	93	285.0	410,400	15,225	2,052
370	Oct. 7	"	"	Idle 33 days	.....	....	0.22	20.43	0.65	78.70	340	28,560	26.1	....	....	....	185.0	266,400	9,883	.....
397	Nov. 5	"	"	Working	200	....	0.26	20.34	0.74	78.66	380	28,800	25.7	52	52	100	213.0	306,720	11,379	1,083
247	May 23	No. 3	No. 6 incline split	"	150	138	0.10	20.65	0.52	78.73	430	27,950	26.2	56	54	87	145.0	208,800	7,746	1,513
296	July 12	"	"	"	200	180	0.20	20.49	1.23	78.08	410	26,650	26.0	56	55	93	326.0	469,440	17,416	2,608
311	Aug. 6	"	"	"	220	180	0.17	20.49	1.20	78.14	490	31,850	26.0	56	56	100	381.0	548,649	29,354	3,048
367	Oct. 5	"	"	Idle 31 days	.....	....	0.10	20.69	0.56	78.65	400	26,000	25.8	....	....	....	145.0	208,800	7,746	.....
374	Oct. 10	"	"	Working	195	100	0.12	20.62	0.87	78.39	460	27,600	26.0	....	....	....	240.0	345,600	12,821	3,456
426	Dec. 12	"	"	"	300	160	0.18	20.47	1.38	77.97	460	27,600	25.7	56	55	93	380.0	547,200	20,301	3,648
246	May 23	"	South level split	"	150	12	0.10	20.72	0.24	78.94	200	16,800	26.2	59	58	93	40.0	57,600	2,136	4,800
297	July 12	"	"	"	200	20	0.10	20.56	0.57	78.77	270	18,900	26.0	59	58	93	107.0	154,080	5,716	7,704
312	Aug. 6	"	"	"	220	40	0.10	20.62	0.61	78.67	275	17,875	26.0	58	57	93	108.0	155,520	5,769	3,888
337	Sept. 13	"	"	Idle 9 days	.....	....	0.10	20.71	0.34	78.85	320	20,800	26.1	....	....	....	70.0	100,800	3,739	.....
392	Nov. 4	"	"	Working	150	20	0.07	20.72	0.41	78.80	330	21,450	25.7	58	57	93	87.0	125,280	4,647	6,264
245	May 23	"	Main return airway	"	150	....	0.11	20.62	0.56	78.71	840	52,940	26.2	59	57	88	296.0	426,240	15,813	2,841
298	July 12	"	"	"	200	....	0.14	20.46	0.99	78.41	725	46,625	26.0	57	56	93	461.0	663,840	24,628	3,319
310	Aug. 6	"	"	"	220	....	0.12	20.47	0.92	78.49	860	52,000	26.0	58	57	93	478.0	688,320	25,536	3,128
393	Nov. 4	"	"	"	150	....	0.16	20.49	0.71	78.64	800	52,000	25.7	59	58	93	369.0	531,360	19,713	3,542
428	Dec. 12	"	"	"	300	....	0.21	20.42	1.33	78.04	800	52,000	25.7	59	57	88	691.0	995,040	36,915	3,316

Michel Colliery.

177	July	16	Old No. 3	Main return airway	Working	30		0.23	20.32	0.73	78.72	390	39,000	26.0	56	55	93	284.0	408,960	15,172	13,632
191	Sept.	4	"	"	"	150		0.23	20.36	0.69	78.74	600	60,000	26.3	53	53	100	402.0	578,880	21,476	3,859
216	Nov.	8	"	"	"	100		0.10	20.04	0.72	79.06	550	55,000	25.7	48	47	93	396.0	570,240	21,155	5,702
223	Dec.	11	"	100 feet from last working-place	"	160		0.09	20.70	0.65	78.56	200	6,000	25.9	43	43	100	39.0	56,160	2,083	351
122	Jan.	10	No. 3 East	West side of slope	"	350	150	0.10	20.42	1.23	78.25	340	14,280	26.4	49	49	100	174.0	250,560	9,295	1,670
134	Feb.	15	"	"	"	350	80	0.12	20.47	1.31	78.10	330	13,860	25.7	47	47	100	180.0	259,200	9,616	3,240
141	Mar.	4	"	"	"	430	200	0.10	20.61	0.98	78.31	320	13,400	25.7	47	46	92	131.0	188,640	6,998	950
159	April	10	"	"	"	410	250	0.12	20.24	1.86	77.78	210	8,820	25.9	49	49	100	163.0	234,720	8,708	939
169	May	9	"	"	"	380	200	0.11	20.35	1.78	77.76	220	9,240	25.9	53	51	86	163.0	234,720	8,708	1,173
174	June	11	"	"	"	350	130	0.14	20.23	2.13	77.50	950	17,100	26.2	54	53	93	364.0	524,160	19,446	4,032
180	July	17	"	"	"	380	240	0.14	20.20	2.31	77.35	1,150	20,700	26.0	53	52	93	478.0	688,320	25,563	2,867
187	Aug.	10	"	"	"	350	200	0.11	20.31	1.81	77.77	330	18,150	25.6	55	54	93	327.0	470,880	17,469	2,354
193	Sept.	4	"	"	"	250	120	0.77	20.46	1.67	77.80	320	21,000	26.3	56	56	100	350.0	504,000	18,698	4,200
206	Sept.	25	"	"	Idle 21 days.			0.09	20.43	1.76	77.72	220	14,500	25.9				255.0	367,200	13,623	
209	Oct.	30	"	"	Working	280	104	0.08	20.45	1.56	77.91	350	23,100	25.7				360.0	518,400	19,232	4,990
218	Nov.	8	"	"	"	270	110	0.09	20.43	1.45	78.03	450	29,700	25.7	50	50	100	430.0	619,200	22,972	5,629
224	Dec.	12	"	"	"	300	120	0.10	20.51	1.28	78.11	350	21,000	25.3				268.0	385,920	14,317	3,216
135	Feb.	15	"	East side of slope	"	350	150	0.08	20.63	0.99	78.30	3,100	13,950	25.7	47	46	93	137.0	197,280	7,319	1,315
142	Mar.	14	"	"	"	430	50	0.05	20.66	0.84	78.45	2,050	10,025	27.7	40	40	100	84.0	120,960	4,487	2,419
160	April	10	"	"	"	410	60	0.09	20.56	1.15	78.20	250	11,250	20.9	44	44	100	128.0	184,320	6,838	3,072
170	May	9	"	"	"	380	40	0.10	20.40	1.34	78.16	350	14,000	25.9	46	46	100	187.0	269,280	9,990	6,732
181	July	17	"	"	"	380	40	0.09	20.51	0.95	78.45	2,500	11,250	26.0	53	52	93	106.0	152,640	5,662	3,816
194	Sept.	4	"	"	"	250	50	0.09	20.52	0.81	78.48	310	12,400	26.3	55	55	100	100.0	144,000	5,342	2,880
205	Sept.	21	"	"	Idle 21 days.			0.08	20.60	0.83	78.49	225	9,000	25.9				74.0	106,560	3,953	
219	Nov.	8	"	"	Working	270	30	0.09	20.68	0.59	78.64	3,500	16,200	25.7	47	47	100	95.0	136,800	5,075	4,560
226	Dec.	12	"	"	"	300	30	0.06	20.72	0.69	78.53	275	11,000	25.3				75.0	108,000	4,006	3,600
120	Jan.	10	"	No. 6 East split	"	350	100	0.05	20.70	0.71	78.54	530	31,800	26.4	58	58	100	225.0	324,000	12,020	3,240
133	Feb.	15	"	"	"	350	120	0.04	20.79	0.22	78.95	520	23,400	25.7	40	40	100	51.0	73,440	2,724	612
140	Mar.	4	"	"	"	430	180	0.08	20.67	0.78	78.47	520	31,200	25.7	40	40	100	243.0	349,920	12,982	1,944
168	May	9	"	"	"	380	140	0.06	20.57	0.85	78.52	750	33,750	25.9	47	47	100	286.0	411,840	15,279	2,941
172	June	11	"	"	"	350	200	0.08	20.57	0.85	78.50	700	31,500	26.2	46	46	100	267.0	384,480	14,267	1,922
178	July	17	"	"	"	380	100	0.09	20.56	0.74	78.61	700	31,500	26.0	52	52	100	233.0	335,520	12,447	3,355
186	Aug.	10	"	"	"	350	100	0.14	20.17	2.32	77 37	700	31,500	25.6	60	60	100	730.0	1,051,200	38,999	10,512
192	Sept.	4	"	"	"	250	80	0.10	20.54	0.85	78.51	700	28,000	26.3	58	58	100	238.0	343,720	12,714	4,284
204	Sept.	25	"	"	Idle 21 days.			0.08	20.63	0.70	78.59	500	22,500	25.9				157.0	226,080	8,387	
217	Nov.	8	"	"	Working	270	130	0.09	20.59	0.68	78.64	600	14,000	25.7	52	52	100	95.0	136,800	5,075	1,052
127	Jan.	12	"	Main return airway	"	350		0.14	20.51	1.01	78.34	1,230	77,490	25.8	47	47	100	781.0	1,124,640	41,724	3,213
136	Feb.	15	"	"	"	350		0.12	20.54	0.96	78.38	1,150	75,900	25.7	46	46	100	728.0	1,048,320	38,892	2,995
143	Mar.	4	"	"	"	430		0.11	20.49	1.18	78.22	1,050	69,300	25.7	47	47	100	817.0	1,176,480	43,647	2,736
161	April	10	"	"	"	410		0.13	20.46	1.11	78.30	1,100	79,200	25.9	47	47	100	879.0	1,265,760	46,959	3,087
171	May	9	"	"	"	380		0.10	20.41	1.13	78.36	1,000	72,000	25.9	58	58	100	813.0	1,170,720	43,433	3,080
176	June	11	"	"	"	350		0.14	20.43	1.14	78.29	1,000	72,000	26.2	62	62	100	820.0	1,180,800	43,807	3,373
182	July	17	"	"	"	380		0.14	20.41	1.20	78.25	1,300	78,000	26.0	50	50	100	936.0	1,347,840	50,004	3,547
195	Sept.	4	"	"	"	250		0.13	20.41	1.10	78.36	1,100	72,600	26.3	56	56	100	798.0	1,149,120	42,632	4,596
207	Sept.	25	"	"	Idle 21 days.			0.12	20.33	1.48	78.07	590	59,400	25.9				879.0	1,265,760	46,959	
211	Oct.	30	"	"	Working	280		0.14	20.42	1.01	78.43	1,050	66,150	25.7				667.0	960,480	35,633	3,430
320	Nov.	8	"	"	"	270		0.10	20.51	0.89	78.50	1,100	69,300	25.7	46	46	100	616.0	887,040	32,909	3,285
227	Dec.	12	"	"	"	300		0.08	20.47	0.96	78.49	1,250	78,750	25.3				755.0	1,087,200	40,335	3,624
131	Feb.	14	New No. 8	No. 1 incline split	"	600	160	0.19	20.44	0.27	79.10	1,300	9,100	25.2	41	41	100	24.0	34,560	1,282	216
149	Mar.	5	"	"	"	520	140	0.16	20.49	0.19	79.16	1,350	9,450	25.0	40	40	100	17.0	24,480	908	174
155	April	9	"	"	"	500	215	0.11	20.60	0.15	79.14	1,750	12,250	25.2	54	54	100	18.0	25,920	961	120
124	Jan.	11	"	No. 4 incline split	"	600	220	0.08	20.83	*Nil.*	79.09	1,300	5,200	25.2	66	66	100				
130	Feb.	14	"	"	"	600	270	0.04	20.83	Trace.	79.13	350	8,800	25.2	40	39	92				
148	Mar.	5	"	"	"	520	200	0.05	20.85	0.03	79.07	550	8,800	25.0	41	40	93	2.0	2,880	106	14
154	April	9	"	"	"	500	150	0.09	20.69	0.09	79.13	750	12,000	25.2	58	58	100	10.0	14,400	534	96
164	May	8	"	"	"	500	90	0.30	20.37	0.22	79.11	500	4,000	25.4	47	47	100	8.0	11,520	427	128
123	Jan.	11	"	No. 6 incline split	"	600	200	0.10	20.69	0.13	79.08	300	2,400	25.2	66	66	100	3.0	4,320	160	21
147	Mar.	5	"	"	"	520	180	0.06	20.78	0.18	78.98	250	1,500	25.0	52	48	74	2.0	2,880	106	16

RETURNS FROM MINE-AIR SAMPLES TAKEN IN COAL-MINES—*Concluded.*

Michel Colliery—Concluded.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or Idle.	Tonnage of Mine per Day.	Tonnage of Split per Day.	Chemical Analysis.				Velocity of Air in Feet per Minute.	Quantity of Air in Feet per Minute.	Barometer.	Hygrometer.			Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Lb. of Methane per Day.	Cubic Feet of Methane per Ton of Coal mined.
							CO_2.	O.	CH_4.	N.				Dry Bulb.	Wet Bulb.	Humidity.				
126	Jan. 11	New No. 8	Main return airway	Working	600	....	0.15	20.67	0.11	79.07	1,200	72,000	25.2	42	42	100	79.0	113,760	4,220	189
132	Feb. 14	"	"	"	600	....	0.07	20.71	0.09	79.13	750	52,500	25.5	40	40	100	47.0	67,680	2,510	112
150	Mar. 5	"	"	"	520	....	0.10	20.71	0.11	79.08	570	39,900	25.0	38	38	100	43.0	61,920	2,297	119
156	April 9	"	"	"	500	....	0.10	20.65	0.12	79.13	800	56,000	25.2	54	54	100	67.0	91,480	3,579	193
166	May 8	"	"	"	500	....	0.05	20.80	0.03	79.12	800	48,000	25.4	45	45	100	14.0	20,160	747	40
							Corbin Colliery.													
118	Jan. 8	No. 4	Main return airway	Working	250	....	0.13	20.65	0.53	78.69	120	12,000	24.5	50	50	100	63.0	90,720	3,365	362
151	Mar. 26	"	"	"	250	....	0.10	20.66	0.50	78.74	1,050	26,250	24.7	64	44	100	130 0	187,200	6,945	749
163	April 23	"	"	"	300	...	0.09	20.63	0.36	78.92	230	23,000	23.9	....	....	....	82.0	118,080	4,380	393
177	June 19	"	"	"	300	....	0.09	20.65	0.27	78.99	225	22,500	24.1	....	...	..	60.0	86,400	3,205	288

CHART SHOWING THE NUMBER OF CUBIC FEET AND THE NUMBER OF TONS OF METHANE DELIVERED INTO THE ATMOSPHERE BY THE VENTILATING FANS IN THE COAL CREEK COLLIERY, CROWS NEST PASS DISTRICT.

Mine	CUBIC FEET OF METHANE EXPELLED INTO THE ATMOSPHERE PER MINUTE SHOWN GRAPHICALLY. 250 500 750	Per cent of METHANE in Current	Cubic Feet of Air circulating per minute	Cu. ft. of METHANE delivered into the atmosphere per minute	Cu. ft. of METHANE delivered into the atmosphere per day of 24 hours	No. of tons of METHANE delivered into the atmosphere per day of 24 hours.	
No 1 East							
South Side Split.							idle
"		1.82	36,400	662	953,280	17.68	45 hrs
"		1.77	"	644	927,360	17.13	67 "
"		1.80	"	655	943,200	17.49	71 "
"		1.09	"	396	570,240	10.57	73 "
"		1.64	"	596	858,240	15.92	115 "
"		1.70	"	618	889,920	16.50	119 "
"		1.68	"	611	879,840	16.32	121 "
"		1.54	"	560	806,400	14.95	141 "
"		1.55	"	564	812,160	15.06	165 "
"		1.57	35,000	549	790,560	14.66	9 days
"		1.52	"	532	766,080	14.21	"
"		1.33	"	465	669,600	12.42	10 days
"		1.73	31,500	544	783,360	14.53	12 "
"		1.61	32,900	529	761,760	14.13	13 "
"		1.62	31,500	510	734,400	13.62	14 "
"		1.64	"	516	743,040	13.78	15 "
"		1.63	"	513	738,720	13.70	16 "
"		1.65	"	519	747,360	13.86	17 "
"		1.61	"	507	730,080	13.54	19 "
"		1.45	30,800	446	642,240	11.91	23 "
"		1.57	28,000	439	632,160	11.72	26 "
"		1.50	29,400	441	635,040	11.77	28 "
"		1.52	30,800	468	673,920	12.50	30 "
"		1.48	34,300	507	730,080	13.54	Working 1 day
"		1.43	"	490	705,600	13.08	" 2 "
"		1.61	32,900	529	761,760	14.13	" 3 "
"		1.62	"	532	766,080	14.21	" 7 "
"		1.66	"	546	786,240	14.58	" 8 "
"		1.64	32,200	528	774,720	14.37	" 9 "
No 1 South							
Main return airway		1.24	39,000	483	695,520	12.90	Idle 10 days
"		1.14	"	444	639,360	11.86	" 12 "
"		1.31	35,750	467	672,480	12.47	" 13 "
"		1.62	31,200	505	727,200	13.48	" 19 "
"		1.45	"	446	642,240	11.91	" 15 "
"		1.32	32,500	494	711,360	13.19	" 16 "
"		1.40	29,250	408	587,520	10.89	" 17 "
"		1.46	39,000	569	819,360	15.19	" 31 "
"		1.11	"	432	622,080	11.53	Working 2 days
"		1.25	"	487	701,280	13.00	" 3 "
"		1.41	"	549	790,560	14.66	" 4 "
"		1.19	"	464	668,160	12.39	" 5 "
"		1.30	"	507	730,080	13.54	" 8 "
"		1.35	"	526	757,440	14.05	" 9 "

OUTBURSTS OF GAS.

Several blow-outs of gas occurred in the Crowsnest Pass mines during the year. On January 10th, 1918, a blow-out of coal and gas occurred in No. 26 room, off No. 10 East slope, No. 1 East mine, Coal Creek Colliery; details of same as furnished by Senior Inspector Strachan are herewith given:—

"*Report of Blow-out of Coal and Gas in No. 1 East Mine on the Morning of January 10th, 1919.*

"I have the honour to report a blow-out of gas in No. 1 East mine, Coal Creek, shortly after midnight of Thursday, resulting in the displacement of about 45 tons of coal and giving off large quantities of gas.

"The blow-out took place in No. 26 room, off No. 10 East slope, about 12.30 a.m. on Friday, 10th inst., while the regular shift was at work. Inspector Lancaster, who was in Coal Creek on the 10th inst., took a sample of the gas (sample No. 150) as close to the face as possible. According to the description given by Mr. Lancaster and others, this blow-out is different from that of November 7th in No. 3 North room, as the coal displaced was mostly round or coarse and not fine dust.

"I visited the place on Tuesday, the 15th inst., after a large amount of the coal had been loaded out, and found that a large cavity had been left ahead of the working-face. This cavity was about 16 feet deep, about 9 feet wide, and 8 feet high. The aperture or mouth was small and bulged out inside, probably due to the roof and sides caving, either while the gas was blowing out or after. This place is about 600 feet south from the No. 3 room, which blew out on November 7th, No. 3 room being driven north and No. 26 room south from No. 10 East slope.

"I interviewed nearly all the workmen who were in the vicinity when the blow-out occurred, and it is noticeable that for at least two places on either side of No. 26 room the workmen thought it was coming out in their place, the rumbling sounded so close.

"About five places away nothing very peculiar was noticed, as slight 'bumps' are common, and the men continued to work until withdrawn by the fireboss; this refers to the workmen on the other split.

"All the workmen in the vicinity agree that they knew there was going to be a blow-out, as it seemed to roll, just like thunder, or a car running above you, for about two to four minutes; therefore they were all out on the Main slope before it blew out. Even there the amount of dust was noticeable, and the gas, of course, filled the air-current on the return side. No. 26 room is the first place on the North split, and there was no extra amount of gas in the South split.

"Personally, I think, after investigating this blow-out, that it was not nearly as strong as that of November 7th, and sufficient time or warning seemed to have been given to allow of the men escaping before it occurred. I have tried to impress, and have requested the officials to do so, the importance of the men, whenever they hear the noise indicative of a blow-out, to immediately retire, and at the same time to warn any who are near the place.

"It may be that these blow-outs may get less as we travel south, but it will require some time to determine; the overburden at this point is not excessive, and so far there is no coal taken out underneath. I am enclosing a sketch, which will give you an idea of the position.

"None of the timbers were blown out; on the high side (where the blow-out occurred) the timbers were scarcely disturbed, while on the low side the posts were all swung outwards for four sets."

"BUMPS."

No severe "bumps" have occurred during the year, but several small disturbances have been reported, which resulted in caves occurring at the working-faces and the liberation of large quantities of methane, causing the workmen to withdraw from the mine.

It is the opinion of the writer that a great many of these caves resulting from these small disturbances could be avoided by the use of heavier timber and more care being given to the lagging and bracing of the same.

MINE FIRES.

There has been more or less trouble with mine fires during the year at Corbin, Coal Creek, and Princeton Collieries.

The fire reported at Corbin Colliery during 1917 spread to a lower level, but was successfully sealed off in October, 1918.

There was a very serious outbreak of fire in No. 1 South mine, Coal Creek Colliery, reported early in November, which was successfully dealt with by loading out. Fortunately there was a good supply of water convenient, by the use of which the fire was kept from spreading until the burning material was loaded out, which was successfully accomplished about the middle of December.

A further outbreak in the old fire area was reported from the Princeton Colliery during the latter end of November. This area has been sealed off from the remainder of the mine for some time, but the fire burned over the stoppings into the present working; this was sealed off again by building a new line of stoppings outside of the old ones.

The fires reported this year were originated by spontaneous combustion, the principal cause of which is lack of sufficient ventilation. Sufficient attention is not exercised by the management in keeping old districts in a reasonably good condition. Abandoned districts should be effectively sealed off or thoroughly ventilated.

EXPLOSIONS.

No explosions occurred during the year 1918. A further report is herewith submitted on the explosion which occurred in No. 3 mine, Coal Creek Colliery, on April 5th, 1917.

IMPROVEMENTS INAUGURATED IN THE MINES OF THE PROVINCE DURING THE YEAR.

A further reduction in the use of naked lights in coal-mines was effected during the year. There is only one mine, which is a small one, that is using naked lights. A few naked lights are used on the main haulage-roads in three other mines where electric haulage is in use.

Introduction of Electric Safety-lamps.—The total number of electric safety-lamps in use in the Province at the end of 1918 is 2,665, an increase of 1,107 during the year. Over 61 per cent. of the safety-lamps in use in the Province are electric lamps.

The electric safety-lamp is finding much favour with both the operators and workmen, and it is claimed by some of the larger operating companies that it has reduced the minor accidents 50 per cent. Apart from the above, it gives almost as much light as a naked light, without the risk attached to the use of the latter.

Introduction of the Burrell Gas-detector.—The Burrel gas-detector has been used extensively during the year for testing for smaller quantities of methane than can be detected with a safety-lamp. It has frequently been checked by chemical analyses of samples taken at the same time, and the results have been remarkable. All the mines are now equipped with this detector, and the Inspectors on each monthly visit test all the return air of the various splits and main return airway. The officials of the company have them in use daily. Tabulated data showing comparison between tests made with Burrell gas-detector and chemical analyses on 149 samples is herewith attached.

COMPARATIVE TESTS TAKEN WITH BURRELL GAS-DETECTOR AND CHEMICAL ANALYSIS.

Crowsnest District.

(Samples taken by Inspectors Robert Strachan and Wm. Lancaster.)

Sample No.	Chemical Analysis.	Burrell Detector.
158	0.45	0.4
168	0.47	0.6
192	0.64	0.8
193	0.57	0.7
162	1.92	1.5
176	1.26	1.5
180	2.10	2.2
205	1.69	1.5
234	1.95	1.6
290	2.28	2.0
321	2.44	2.0
373	1.11	0.9
381	1.19	1.3
442	1.05	1.0
443	0.89	0.7
289	1.93	1.5
320	1.78	1.3
161	1.00	1.3
179	1.78	1.6
204	1.46	1.2
233	1.67	1.2
153	2.54	2.2
183	2.17	2.5
198	2.3	2.6
241	2.55	2.2
287	1.94	2.0
301	1.82	2.2
313	2.34	2.5
364	1.61	1.6
377	1.62	1.6
169	0.79	0.8
182	1.23	1.9
197	1.47	1.5
242	1.68	1.4
302	1.53	1.4
314	1.46	2.0
340	0.93	1.0
387	1.28	1.1
163	1.28	0.7
184	1.26	1.6
199	1.38	1.5
243	1.16	1.0
303	1.27	1.1
388	1.09	1.0
389	1.78	2.2
174	1.08	1.3
196	1.88	1.7
238	1.59	1.6
282	1.67	1.2
305	1.46	1.2
318	1.65	1.5
173	2.52	2.5
239	1.38	1.5
281	1.44	1.2
Average of 54 samples	1.52	1.4
304	1.54	1.0
317	1.35	1.0
172	1.38	1.5
185	1.55	1.8
200	1.40	1.5
240	1.21	1.1
280	1.21	1.2
306	1.34	1.0
160	0.43	0.2
166	0.30	0.3
202	0.49	0.4
278	0.72	1.0
294	0.72	0.5
308	0.44	0.3
165	1.15	0.9
191	0.57	1.1
201	0.75	0.5
279	0.96	1.2
309	1.24	1.0
203	0.69	0.4
277	0.66	0.7
295	0.72	1.1
307	0.68	0.6
296	0.76	0.8
311	1.23	1.0
370	1.20	0.9
297	0.57	0.3
312	0.61	0.6
298	0.99	0.9
343	1.62	1.5
352	1.43	1.3
409	0.99	1.3
423	0.68	0.5
432	0.20	0.5
433	0.75	0.5
434	0.69	0.5
151	1.01	0.9
152	1.48	1.2
153	2.54	2.2
159	1.20	1.0
Michel Colliery.		
177	0.73	0.8
169	1.78	2.0
193	1.67	1.4
135	0.99	1.4
170	1.34	1.1
181	0.95	1.2
194	0.81	1.1
168	0.85	0.5
172	0.85	1.3
178	0.74	0.6
193	0.85	0.5
127	1.01	1.4
136	0.96	1.5
143	1.18	1.5
161	1.11	1.0
171	1.13	0.7
182	1.20	1.1
211	1.01	0.7
123	0.13	0.3
147	0.18	0.1
Average of 60 samples	0.98	0.94

Vancouver Island.

(Samples taken by Dudley Michell.)

Sample No.	Chemical Analysis.	Burrell Detector.	Sample No.	Chemical Analysis.	Burrell Detector.
117	0.29	0.4	179	2.27	2.1
89	0.41	0.5	183	2.16	2.2
113	0.34	0.3	184	2.18	2.0
142	0.35	0.7	185	2.12	1.7
95	0.76	0.8	186	0.17	0.2
112	0.83	0.8	192	0.78	0.6
143	0.83	0.9	100	0.75	0.4
98	0.34	0.4	125	0.93	0.5
114	0.35	0.3	157	1.07	1.0
145	0.33	0.3	180	1.88	1.6
101	1.63	1.3	128	0.79	0.5
127	1.50	1.4	159	0.88	1.0
158	1.49	1.7	182	1.18	1.2
126	1.34	1.5	106	0.29	0.2
188	1.81	1.9	129	0.29	0.3
189	0.34	0.2	131	0.13	0.3
99	1.83	1.7			
124	1.59	1.6	Average of 35 samples	1.02	0.98
156	1.76	1.9			

Totals.—Average of 149 check samples taken during 1918: Chemical analysis, 1.17 per cent.; Burrell gas-detector, 1.10 per cent.

Treatment of Coal-dust.—The coal-dust question has received very serious attention during the year, and various treatments have been adopted at the mines in the Province.

Ventilation.—A good deal of attention has been given during the year to ventilation, and special efforts have been made to keep the percentage of methane in the return airways down to a minimum. Gratifying results have been obtained in the Crowsnest Pass District, and I have before me a report from the Senior Inspector of the district, an extract from which reads as follows: "The percentage of methane in the various air-currents is fairly low, as shown by the Burrell gas-detector, only in four cases rising above 1 per cent.—namely, South level split, No. 3 mine; No. 1 South; North split, No. 1 East; and the incline split, No. B North, of Coal Creek mines.

"In Michel only one split—namely, the West split, No. 3 East mine—shows above 1 per cent."

MINE-AIR SAMPLING IN METALLIFEROUS MINES.

During the year 1918 thirty-five mine-air samples were taken in the metalliferous mines of the Province. Of this number, eight were spoiled in transit, accidents, laboratory, or by reason of incomplete records. Much valuable information has been obtained from these samples in reference to the hydrogen, carbon-monoxide, and carbon-dioxide contents.

The following table shows the tabulated data obtained from mine-air sampling in the metalliferous mines:—

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RETURNS FROM MINE-AIR SAMPLES TAKEN IN THE VARIOUS METALLIFEROUS MINES IN THE PROVINCE OF BRITISH COLUMBIA, 1918.

East Kootenay District.

Sample No.	Date.	Mine.	Location in Mine.	Chemical Analysis.					Hygrometer.			Remarks.
				CO_2.	O.	CO.	H.	N.	Dry Bulb.	Wet Bulb.	Humidity.	
3	Aug. 7	Sullivan	1,087 stope	0.20	20.46	0.04	.....	79.30	48	48	100	Sample taken 8 hours after blasting.
4	" 7	"	1,188 "	0.28	20.33	0.06	.....	79.33	50	49	93	Sample taken 16 hours after blasting.
5	Sept. 10	Lake Shore	1,752 "	0.06	20.84	.....	.....	79.10	51	51	100	Sample taken 17 hours after blasting.
6	" 14	Sullivan	1,084 "	0.17	20.54	.....	.....	79.29	60	60	100	Sample taken 4 hours after blasting.
7	" 14	"	1,189 "	0.26	20.24	.....	.....	79.49	64	64	100	Sample taken 4 hours after blasting.

West Kootenay District.

1	Nov. 15	Bluebell	350 feet down shaft	0.12	20.72	.....	.....	79.16	.....	.....	.....	
2	" 16	Highland	In face of lower tunnel, 1,700 feet from surface	0.35	20.42	0.05	.....	79.18	.....	.....	.....	
3	" 17	Florence	At face of No. 5 tunnel	0.08	20.78	0.03	.....	79.11	.....	.....	.....	
4	" 27	Granby	No. 2 tunnel, 1,000 feet from surface	0.03	20.95	.....	.....	79.02	.....	.....	.....	
18	Mar. 9	Le Roi No. 2	Stope No. 6, P.E.	0.25	20.50	.....	.....	79.25	.....	.....	.....	
19	Nov. 13	Emerald	150 feet from face of No. 4 tunnel	0.14	20.70	.....	.....	79.16	.....	.....	.....	
20	" 15	Eureka	100 feet from face of No. 3 tunnel	0.25	20.52	.....	.....	79.23	.....	.....	.....	
21	" 21	Galena Farm	No. 1 stope off Intermediate level	0.12	20.82	.....	.....	79.06	.....	.....	.....	
22	" 21	Bosun	50 feet from face of No. 4 tunnel	0.04	20.89	.....	.....	79.07	.....	.....	.....	Sample taken 17 hours after blasting.
23	" 26	War Eagle	617 crosscut north	0.25	20.75	.....	.....	79.00	.....	.....	.....	Sample taken 21 hours after blasting.
25	" 28	Le Roi	1,689 crosscut west	0.08	20.78	.....	.....	79.14	.....	.....	.....	Sample taken 8½ hours after blasting.
26	" 29	Le Roi No. 2	No. 5 G.W. winze	0.09	20.80	.....	.....	79.11	.....	.....	.....	Sample taken 8½ hours after blasting.
27	Dec. 7	Inland Empire	Stope 60 feet below Main tunnel level	0.08	20.76	Trace.	.....	79.16	.....	.....	.....	Sample taken 17½ hours after blasting.

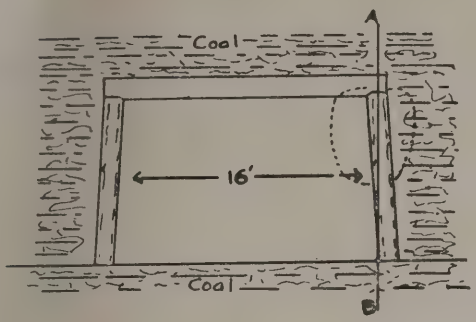
Coast District.

13	Dec. 4	Britannia	Wylie stope, E. 1,000-foot level	0.05	20.82	Trace.	.....	79.13	45	45	100	Sample taken 7½ hours after blasting.
14	" 4	"	Gillies stope, W. 850-foot level	0.09	20.79	"	.....	79.12	44	44	100	Sample taken 9 hours after blasting.
15	" 5	"	Bluff stope, 1,200-foot level	0.06	20.82	"	.....	79.12	42	42	100	Sample taken 8½ hours after blasting.
16	" 5	"	Zero vein, Jane Creek tunnel	0.30	20.56	"	.....	79.14	45	44	93	Sample taken 9 hours after blasting.
17	" 5	"	Beta tunnel	0.73	19.49	0.11	.....	79.67	50	50	100	Sample contains trace of ethylene.

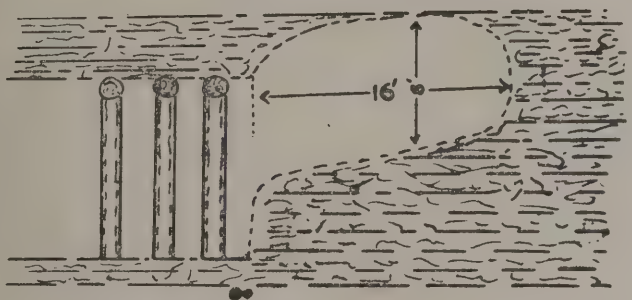
Northern District.

23	Nov. 15	Drum Lummon	No. 1 stope	0.29	20.04	.....	0.05	79.62	60	56	76	
24	" 15	"	Main drift, 400 feet from portal	0.11	20.79	.....	0.03	79.07	60	56	76	
25	" 25	Hidden Creek	60 drift, near 113 chute	0.05	20.86	.....	Trace.	79.09	62	54	58	Sample taken 6 hours after blasting.
26	" 25	"	730 drift, 530 level	0.09	20.85	.....	"	79.06	62	54	58	Sample taken 6 hours after blasting.
29	" 26	Quartz Point	No. 3 stope	0.13	20.82	.....	"	79.05	68	62	68	Sample taken 5 hours after blasting.
30	" 27	Macy Quartz	No. 1 drift, No. 1 pocket	0.09	20.69	Trace.	"	79.22	66	62	78	

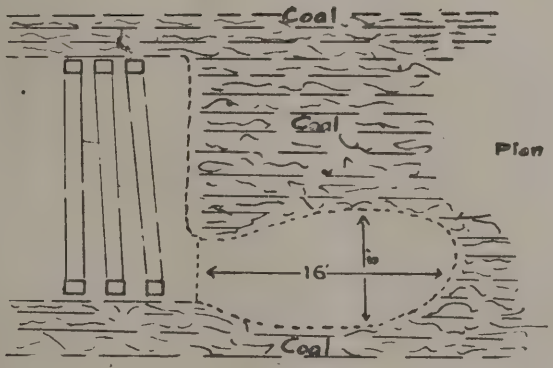
Sketch to illustrate 'Blow-out' in No 26 Room, No 1 East Mine, Coal Creek, B.C. (seam 15' to 30' thick)



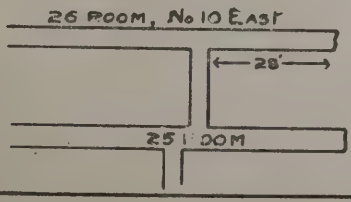
Section across face



Section through 'A-B'



Plan



Point of Blowout

B.C. Bureau of Mines.

I am much indebted to Dr. Eugene Haanel, Director of the Mines Branch, Ottawa, for co-operation in the work; the Dominion Department furnishing the sample-bottles, with franking privileges, and making all analysis without charge of any kind.

Mine-rescue Work.

During the year the Department ordered six sets of the Gibbs oxygen breathing apparatus for the Fernie Mine-rescue Station. This apparatus has been proven much more efficient than the Draeger or Proto apparatus.

The Canadian Western Fuel Company ordered six sets of Gibbs, the Granby Consolidated Mining, Smelting, and Power Company four sets, and the Pacific Coast Coal Company two sets, making a total of eighteen sets ordered during the year. Shipments of the above have been delayed owing to the priority of war contracts. The Mine Safety Appliance Company is the distributers of this apparatus, which is built by the Edison Phonograph Works under contract to the United States Bureau of Mines. The first 500 sets of this apparatus were supplied to the United States Government during the latter part of 1918.

There were nineteen certificates of competency in mine-rescue work issued by the Department during the year; four at Nanaimo, fourteen at Cumberland, and one at Fernie, as shown by the attached list:—

List of Persons who have received Mine-rescue Certificates during the Year 1918.

Date.	Name.	Where trained.	Cert. No.	Date.	Name.	Where trained.	Cert. No.
April 30	Laird, Robert.....	Nanaimo....	400	June 12	Swanson, Sinclair	Cumberland.	410
" 30	Holliday, William ...	"	401	" 12	Franceschini, Louis...	"	411
" 30	Nichol, Richard.....	"	402	" 12	Biggs, John G.....	"	412
" 30	Wallace, George.....	"	403	" 12	Evans, William George	"	413
June 12	Wilkinson, George...	Cumberland.	404	" 12	Quinn, John Graham .	"	414
" 12	Thomson, John	"	405	" 12	Brown, Robert.	"	415
" 12	Gillies, William	"	406	" 12	Graham, Charles	"	416
" 12	Williams, John S....	"	407	" 12	Beveridge, William...	"	417
" 12	Eccleston, Thomas...	"	408	Oct. 4 24	Puckey, John T	Fernie	418
" 12	Domanis, Alexander..	"	409				

Technical Classes on Mining.

Considerable interest has been maintained in this work around the coal-mining centres. The chief difficulty met with seems to be getting classes to suit the different shifts.

Considerable attention is being given by the Education Department and the Mines Department towards issuing a Government correspondence course for firebosses and shotlighters, overmen and managers, also a course for mine surveyors. This should be of great value to men wishing to qualify for certificates of competency.

Supervision of Coal-mines.

During the year fourteen coal companies operated seventeen collieries, with thirty-nine mines, employing 3,658 men underground. In the supervision of these underground employees there were twenty-two managers, thirty-two overmen, and 175 firebosses and shotlighters, a total of 229 officials, or one official for every sixteen persons employed underground.

I desire to express my appreciation of the faithful co-operation and assistance afforded me throughout the year by the District Inspectors and Instructors in mine-rescue and first-aid work.

In the light of the experience of the past year, I beg to submit the following concluding remarks and suggestions:—

Suggestions regarding Legislation.

From the evidence brought out at the inquest in connection with explosion at No. 3 mine, Coal Creek, and the subsequent tests made regarding the percentage of methane in the air-current to height of flame-cap on a safety-lamp, it is apparent that some rule should be embodied in the "Coal-mines Regulation Act" compelling the withdrawal of men when the percentage reaches a fixed quantity. The limit set by the British Act is 2½ per cent. A rule has been established

by the management of the Crowsnest Pass mines, at the suggestion of the Mines Department, to the effect of establishing the withdrawal percentage at 2½ per cent., or ¼-inch gas-cap, but this rule should be embodied in the "Coal-mines Regulation Act."

While blasting did not enter into this explosion as a possible cause, the writer is of the opinion that some limit should be set for the permissive percentage of gas in the air in which to allow blasting operations.

At the present time the requirements of the various Acts in different countries are very vague on this point, dealing more with permissive explosives than with percentages of gas; but the writer is of the opinion that even with the use of permissive explosives there ought to be a limit set for percentages of gas in the air when blasting is allowed.

The writer is also of the opinion that legislation should be enacted compelling certain lines of treatment of coal-dust in the mines. It has now been proved beyond doubt that coal-dust is the greatest menace in the mines for propagating an explosion. The modern ventilating equipment of the mines does not allow any large accumulations of gas, providing the conducting of the current is done in a proper manner, and it would be hard to find a case in the present day where there would be sufficient gas to propagate an explosion throughout the mine. But with a very small quantity of coal-dust added this becomes possible in the event of any primary explosion of gas; hence the need of laws compelling the removal and treatment of coal-dust.

The writer would also suggest that changes be made in the Act regarding the standardization of the ventilation in mines, as to what an adequate amount of ventilation means as stated that the workings of the mine shall be in a fit state for working and passing therein. The British Columbia "Coal-mines Regulation Act" reads as follows: "An adequate amount of ventilation shall mean not less than one hundred cubic feet of pure air per minute for each horse or mule employed in the mine, and as much more as the Inspector of Mines may direct shall sweep the face of each working-face." This standard cannot be adopted generally, as there is such a variation of conditions in the various mines.

The British Act reads as follows: "A place shall not be deemed to be in a fit state for working or passing therein if the air contains either less than nineteen per cent. of oxygen or more than one and a quarter per cent. of carbon dioxide, and an intake airway shall not be deemed to be normally kept free from gas, inflammable gas, if the average percentage of inflammable gas found in six samples of air taken by an Inspector in the air-current in that airway at intervals of not less than a fortnight exceeds one-quarter." The writer would suggest that a similar clause to the above should be adopted in the British Columbia "Coal-mines Regulation Act."

A standard of the conditions allowed being set, then every mine would have to standardize to these conditions; whereas now in the existing clause the amount of ventilating is set in cubic feet per man, boy, and mule. This amount may be all right in non-gaseous mines and yet totally inadequate in gaseous mines.

In concluding this report, I beg to draw your attention to the system of inspection in British Columbia—namely, that an inspection must be made every month—which means that the inspections come at regular intervals, and becomes practically a formal inspection and can be prepared for by the mine officials. An Inspector starting off on his monthly inspection, having a fairly large district, cannot deviate much from a regular round if he has to visit each mine monthly, so that it can be told to a few days when he will be at a certain mine, and conditions are naturally made as good as possible for his visit. The result is easily seen—he makes an inspection under favourable conditions and posts his report, and the under-officials take refuge behind his report as being the standard for the month. The situation then develops almost making the Inspector manager of the mine, and consequently relieving the officials in this respect. In the writer's opinion the visit should be more of a surprise visit, even though he should only inspect a portion of the mine, and when negligence is in evidence stringent measures should be adopted.

Neither in Great Britain, France, Belgium, or even in the neighbouring Provinces, is the Inspector compelled to visit each mine and every part thereof monthly, but can make them oftener where necessary, or less when not necessary.

Frequent inspections in some cases may be very good, but in some cases too frequent inspection may be more harmful than otherwise, as it tends to encourage the officials to rely on the Inspector for seeing the requirements of the Act carried out, and thereby neglecting their own duties in that respect.

List of Holders of Certificates of Competency in Mine-rescue Training for the Province of British Columbia.

Name.	Date.	Cert. No.	Name.	Date.	Cert. No.
Adamson, Robert	Sept. 2, 1913	45	Clark, Joseph	July 23, 1915	221
Addison, Walker	Jan. 26, 1916	289	Clark, Louis	July 23, 1915	214
Ainsworth, Edward	May 5, 1914	124	Clarkstone, Wm. Walter	March 6th, 1916	308
Aitken, Thomas M	Jan. 26, 1916	261	Clements, Edwin F	Oct. 13, 1916	356
Almond, Walter	July 24, 1916	343	Commons, William	June 30, 1913	22
Allan, Alexander McD	June 30, 1913	32	Coomb, Alexander	Jan. 26, 1914	117
Allan, Hamilton	July 27, 1917	360	Corlett, William D	June 1, 1914	150
Andren, Alfred	Jan. 28, 1916	303	Courtney, Albert Warren	July 27, 1917	363
Anderson, Robert	June 30, 1913	27	Craig, James	July 15, 1916	324
Arbuckle, John	July 1, 1914	157	Crawford, David	Sept. 12, 1913	80
Archibald, George	July 23, 1915	222	Crichton, Robert	Aug. 1, 1914	161
Archibald, Thomas	Sept. 6, 1916	353	Crosscombe, James	Nov. 1, 1914	178
Baggaley, John	June 10, 1913	15	Cullinane, James	Nov. 1, 1914	169
Bain, James	Nov. 1, 1913	90	Cunliffe, Thomas	Dec. 1, 1914	192
Ball, Alfred	July 24, 1916	341	Dando, Caleb	June 30, 1915	216
Ball, Benjamin	Dec. 1, 1914	190	Dando, Caleb V	June 30, 1915	213
Barlow, Benjamin R	Oct. 20, 1917	392	Dando John	June 30, 1915	212
Barnes, James	Nov. 1, 1914	177	Davidson, Hugh McL	Nov. 25, 1915	234
Barton, Joseph	June 1, 1914	129	Davidson, Norman	Jan. 28, 1916	301
Baxter, Robert	Oct. 20, 1917	394	Davis, Stephen	June 22, 1916	314
Baybutt, Thomas	Dec. 12, 1914	199	Dean, John	Jan. 26, 1916	262
Beck, Alexander	Jan. 26, 1914	114	Delaney, James	Nov. 25, 1915	233
Bell, Frederick	Dec. 22, 1915	247	Devlin, Henry	Jan. 26, 1914	104
Bell, John	July 1, 1914	151	Dickinson, Clifford	June 1, 1914	128
Bell, William E	July 15, 1916	329	Dickson, James	June 1, 1914	141
Bengtson, Victor	Aug. 27, 1917	378	Dignan, William	Oct. 20, 1917	396
Bennett, Andrew M	Oct. 13, 1916	357	Domenis, Alex.	June 12, 1918	409
Bevis, Nathaniel	Dec. 22, 1915	254	Drake, Samuel	Jan. 26, 1916	281
Beveridge, James	July 1, 1914	158	Duncan, James	July 1, 1914	153
Beveridge, William	June 12, 1918	417	Dunnigan, James	July 23, 1915	225
Biggs, John	June 10, 1913	18	Dykes, Joseph W	Jan. 26, 1916	257
Biggs, John G	June 12, 1918	412	Eccleston, Thomas	June 12, 1918	408
Blair, J	Sept. 12, 1913	66	Evans, William G	June 12, 1918	413
Blass, Emile	July 27, 1917	361	Ewart, Alexander	Sept. 12, 1913	71
Bonar, Robert	Jan. 26, 1916	263	Ewing, Robert F	June 22, 1916	318
Bond, Frank	Sept. 12, 1913	81	Fairfoull, James	Sept. 12, 1913	72
Brace, Tom	Sept. 12, 1913	54	Fawcett, Albert	March 6, 1916	307
Bradshaw, George	Jan. 26, 1914	116	Ferguson, James N	June 22, 1916	313
Broderick, Matthew	June 30, 1915	214	Fisher, John H	Nov. 1, 1915	229
Brough, William F	Jan. 26, 1916	272	Foran, John T	Nov. 1, 1914	182
Brown, Alexander	March 6, 1916	311	Fowler, Robert	June 30, 1913	35
Brown, David	Jan. 26, 1916	276	France, Thomas	Nov. 1, 1913	88
Brown, Edward	Nov. 1, 1914	179	Franceschini, Louis	June 12, 1918	411
Brown, Frank	Oct. 10, 1917	391	Frater, George	July 15, 1916	327
Brown, James	June 30, 1915	210	Frearson, Albert W	Dec. 1, 1913	95
Brown, John	June 30, 1915	209	Freeland, P. B.	Jan. 28, 1916	302
Brown, John T	Sept. 12, 1913	69	Freeman, Henry N	June 1, 1914	134
Brown, Robert	June 12, 1918	415	Frew, Andrew	Dec. 1, 1914	193
Brown, Robert J	June 30, 1913	23	Galloway, James	July 27, 1917	364
Brown, R. S.	Sept. 12, 1913	63	Geater, James G	Oct. 20, 1917	395
Brown, William A	Dec. 15, 1913	99	Gemmell, James	Sept. 12, 1913	60
Brunt, Henry	July 15, 1916	335	Gibson, Edward	Jan. 26, 1916	285
Bryce, Richard	Dec. 22, 1915	248	Gillespie, John	June 30, 1915	208
Buchanan, Henry	Dec. 22, 1915	251	Gillies, William	June 12, 1918	406
Bullen, Thomas	Sept. 12, 1913	75	Gould, Alfred	Jan. 26, 1916	264
Bushell, James P	June 30, 1913	36	Gourlay, Robert	Oct. 20, 1917	393
Callow, Charles	Oct. 13, 1916	359	Graham, Charles	June 12, 1918	416
Campbell, Andrew	July 27, 1917	362	Graham, Thomas	Jan. 26, 1914	105
Cameron, Samuel	Dec. 22, 1915	250	Gray, George	June 1, 1914	137
Carson, George	June 1, 1914	139	Green, Francis	Nov. 1, 1914	186
Caufield, Bernard	Sept. 1, 1914	166	Greenhorn, John	July 27, 1917	365
Caufield, Edward	Sept. 1, 1914	165	Gregory, William	Sept. 1, 1914	167
Caufield, John	Sept. 2, 1913	43	Griffiths, John	June 1, 1914	149
Challoner, John A	Jan. 26, 1916	280	Groutage, Edgar E	Nov. 1, 1915	230
Charnock, John	Sept. 27, 1917	385	Guinness, Matthew	Jan. 26, 1914	120
Chester, John	Sept. 2, 1913	44	Hamer Joseph	Nov. 1, 1913	86

LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY—*Continued.*

Name.	Date.	Cert. No.	Name.	Date.	Cert. No.
Hamilton, John	June 1, 1914	135	Lunan, George	Sept. 6, 1916	346
Hamilton, John	July 27, 1917	366	Lynch, Stewart	June 30, 1913	28
Hamilton, Robert	June 1, 1914	130	Maffeo, Peter	July 27, 1917	369
Hancock, Arthur	Dec. 15, 1913	100	Male, Philip	July 15, 1916	326
Harrison, Albert E	Oct. 1, 1914	171	Malone, Patrick	Nov. 25, 1915	237
Hawkins, John	Nov. 1, 1914	183	Matlman, James	June 30, 1913	34
Hays, William	July 23, 1915	223	Marrs, John	Jan. 26, 1916	287
Healer, Robert	Nov. 1, 1915	227	March, John	July 24, 1916	342
Hemer, Herbert	June 1, 1914	132	Martin, David	June 10, 1913	6
Henderson, Robert	Dec. 22, 1915	245	Martin, David, Jr	Aug. 1, 1914	160
Hendry, James	Sept. 12, 1913	57	Martin, Henry	May 5, 1914	123
Herd, William	June 30, 1915	203	Mason, Joseph	Dec. 1, 1914	194
Hesketh, Edward	June 1, 1914	143	Mason, Thomas	Jan. 26, 1916	279
Heyes, Edward	Dec. 1, 1914	191	Mawson, John T	Sept. 2, 1913	46
Hindmarsh, Thomas	Sept. 6, 1916	352	Maxwell, George	Sept. 6, 1916	347
Hodgson, James	Jan. 26, 1916	273	Meek, Matthew	June 22, 1916	319
Hollands, Alexander	Sept. 6, 1916	351	Mercer, James	Dec. 18, 1917	398
Holliday, William	April 30, 1918	401	Miard, Henry E	June 10, 1913	11
Houston, Robert	June 22, 1916	312	Michell, Dudley	June 10, 1913	13
Howden, Archibald B	Dec. 1, 1913	93	Michell, George G	March 6, 1916	305
Huby, Norman	Dec. 22, 1915	252	Millar, John A	Jan. 28, 1916	297
Hudson, George	Sept. 12, 1913	77	Miscisco, Nicholas	June 1, 1914	144
Hughes, J. C	Sept. 12, 1913	79	Mitchell, Henry	Nov. 25, 1915	243
Hunt, John	Jan. 26, 1916	282	Montgomery, Edgar G	Oct. 1, 1914	172
Hunter, Frederick	Jan. 26, 1916	283	Moore, George	July 15, 1916	323
Hunter, Thomas	July 27, 1917	367	Moore, John	Sept. 2, 1913	51
Hunter, William	Sept. 1, 1914	163	Moore, William H	June 1, 1914	125
Hutson, Frederick	Dec. 1, 1913	96	Mordy, Thomas	Dec. 22, 1915	246
Hynds, William	Oct. 10, 1917	388	Morgan, John	Nov. 25, 1915	241
Irving, Thomas	July 15, 1916	333	Morgan, William	Oct. 10, 1917	389
Ivey, George D	Aug. 27, 1917	381	Morris, David	Dec. 15, 1913	101
Jackson, Thomas R	Nov. 1, 1914	184	Mottishaw, Samuel K	Jan. 26, 1916	294
James, David	Nov. 1, 1913	87	Moyes, James	July 23, 1915	218
James, Edward	Nov. 1, 1915	228	Murphy, Andrew	Jan. 26, 1916	265
James, William	Nov. 25, 1915	242	Musgrove, John	June 30, 1913	25
Jardine, Alfred	June 1, 1914	131	Myers, Peter	June 30, 1915	202
Jaynes, Frank	June 30, 1915	201	McAlpine, John	June 30, 1913	38
Jemson, James W	Jan. 26, 1914	119	McArthur, John	June 1, 1914	126
John Francis	Jan. 26, 1916	260	McCourt, John	July 1, 1914	154
John, Howell	Sept. 12, 1913	59	McDonald, Allan	July 27, 1917	370
Johnstone, Robert	Aug. 1, 1914	159	McDonald, J	Sept. 12, 1913	78
Jolly, Andrew	July 15, 1916	332	McFagan, Alexander	Sept. 2, 1913	49
Jones Evan	Nov. 1, 1913	91	McFegan, William	June 10, 1913	12
Jones, Samuel	June 30, 1915	206	McGrath, James	Sept. 6, 1916	355
Jones, Samuel	July 27, 1917	368	McGuckie, John	June 1, 1914	110
Jordon, Thomas	Jan. 26, 1916	270	McGuire, Thomas	Dec. 1, 1913	94
Joyce, Walter	Sept. 2, 1913	41	McKelvie, James	June 30, 1913	26
Kenny, Clair F	Jan. 26, 1916	268	McKendrick, Andrew	July 23, 1915	219
Kilburn, George H	Nov. 1, 1914	175	McKibben, Matthew	July 23, 1915	220
Kirkpatrick, James	July 15, 1916	337	McKinnon, D. A	Jan. 28, 1916	295
Kirkwood, John	Sept. 12, 1913	64	McLachlan, Alexander	Nov. 25, 1915	236
Knowles, James E	June 1, 1914	142	McLachlan, James	June 1, 1914	145
Laird, Robert	April 30, 1918	400	McLauchlin, John A	Jan. 28, 1916	296
Lancaster, William	June 10, 1913	7	McLean, Michael	Dec. 12, 1914	198
Lander, Frank	Sept. 2, 1913	42	McMillan, John H	June 30, 1915	204
Lane, Joseph	June 10, 1913	20	McMillan, R	Sept. 12, 1913	68
Lanfear, Herbert	Sept. 2, 1913	52	McNay, Carmichael	June 10, 1913	16
Lantermo, Antonio	Aug. 27, 1917	383	McNeil, Robert	Dec. 22, 1915	256
Lauderbach, Carl	June 22, 1916	320	McPherson, James E	Nov. 1, 1913	83
Lee, George	July 15, 1916	336	Neave, William	Jan. 26, 1914	111
Leeman, Thomas	Dec. 22, 1915	253	Neen, Joseph	Jan. 26, 1916	266
Lewis, Thomas	Jan. 26, 1916	274	Neilson, William	Sept. 6, 1916	345
Leynard, Paul	Jan. 26, 1916	292	Nelson, N. E	Jan. 28, 1916	298
Lindsay, William	Nov. 1, 1914	181	Newbury, Arthur	Jan. 26, 1916	286
Littler, Matthew	Dec. 12, 1914	197	Newman, John	Dec. 18, 1917	399
Loxton, George	Nov. 1, 1913	85	Newton, John	Jan. 26, 1914	103

List of Holders of Certificates of Competency—*Concluded.*

Name.	Date.	Cert. No.
Nichol, Richard	April 30, 1918	402
Nimmo, James	Nov. 1, 1914	187
Nimmo, James Pollock, Jr.	July 27, 1917	371
Nisbet, Robert	Sept. 6, 1916	350
Norris, Joseph	Jan. 26, 1916	293
O'Brien, Charles	Sept. 2, 1913	39
O'Brien, George	June 10, 1913	4
O'Brien, Melbourne M.	Oct. 1, 1914	170
Osborne, Hugh	July 23, 1915	224
Oswald, George L.	Jan. 26, 1916	291
Park, Alexander	July 15, 1916	334
Parkinson, Harry	July 24, 1916	344
Parkinson, Thomas	June 1, 1914	133
Parnham, Charles	June 30, 1915	211
Parrott, John	July 15, 1916	331
Parsons, Herbert	Sept. 27, 1917	386
Patterson, John	Jan. 26, 1916	275
Peacock, James	Aug. 27, 1917	379
Perry, James	Jan. 26, 1914	115
Phelan, Arthur	Sept. 12, 1913	56
Phillips, James Henry	July 24, 1916	321
Phillips, Richard	Sept. 27, 1917	387
Poole, S.	Sept. 12, 1913	65
Price, Walter	June 30, 1913	29
Puckey, John T.	Oct. 24, 1918	418
Purss, David	Nov. 15, 1915	238
Quinn, James	July 24, 1916	340
Quinn, John G.	June 12, 1918	414
Radcliffe, Joseph	Jan. 26, 1914	113
Rafter, Robert	July 27, 1917	372
Rafter, William Benjamin	July 27, 1917	373
Rankin, George	June 30, 1913	31
Rankin, William	June 30, 1913	33
Ratcliffe, Thomas	June 10, 1913	19
Reid, Robert	June 1, 1914	136
Reid, Thomas	Oct. 10, 1917	390
Richards, James	Jan. 26, 1916	284
Rickard, John William	July 27, 1917	374
Roberts, Thomas D.	Nov. 1, 1914	176
Robertson, James H.	Jan. 26, 1916	277
Rogers, Ellis	Dec. 22, 1915	249
Roper, William	July 15, 1916	339
Rowan, Alexander	Nov. 1, 1914	185
Rowbottom, Thomas	Sept. 12, 1913	70
Rowlands, Evon J.	Aug. 27, 1917	380
Rutledge, Edwin	June 30, 1913	37
Scott, George	July 15, 1916	325
Scott, Thomas W.	June 30, 1915	215
Seaton, C. A.	Nov. 1, 1915	232
Seggie, Robert	Jan. 26, 1914	118
Shanks, David	Sept. 12, 1913	48
Shanks, John	June 10, 1913	5
Sharp, James	Sept. 12, 1913	67
Shaw, Thomas J.	Nov. 1, 1913	89
Shaw, William	June 30, 1913	24
Shelledy, Rowland B.	Oct. 1, 1914	168
Sherwin, Edward	Sept. 1, 1914	162
Simpson, Ralph	March 6, 1916	306
Skimming John	Sept. 6, 1916	348
Smith, Arthur E.	Sept. 12, 1913	82
Smith, George	Nov. 25, 1915	235
Smith, Thomas	Jan. 26, 1916	278
Soloski, Angus	Dec. 15, 1913	102
Spicer, John E.	Dec. 22, 1915	255
Spruston, Robert L.	Dec. 1, 1914	189
Spruston, Thomas A.	June 30, 1915	200
Stacey, Reginald	Dec. 18, 1917	397
Staton, Edward	Sept. 6, 1916	349
Stephens, Ralph	March 6, 1916	309
Stephens, Roy	Nov. 1, 1914	174
Stewart, Aaron	Jan. 26, 1916	269
Stewart, Adam	Jan. 26, 1916	271
Stewart, James	June 10, 1913	9
Stewart, John D.	Jan. 26, 1916	106
Stewart, Robert T.	Nov. 1, 1913	92
Stobbart, Ralph	Jan. 26, 1916	259
Stobbart, Jacob	Jan. 26, 1914	108
Stockwell, William	June 10, 1913	17
Stone, William	July 23, 1915	226
Strachan, Robert	June 10, 1913	2
Strand, Peter	Aug. 27, 1917	382
Strang, James	Nov. 25, 1915	239
Strang, James	June 22, 1916	315
Strang, Thomas	Nov. 25, 1915	240
Strang, William	Sept. 12, 1913	73
Sutherland, John	July 15, 1916	330
Swanson, Sinclair	June 12, 1918	410
Taylor, Edward	Dec. 1, 1913	98
Taylor, James	Dec. 1, 1913	97
Taylor, J. T.	Sept. 12, 1913	55
Taylor, Thomas	Jan. 26, 1916	267
Taylor, Thomas H.	Jan. 26, 1916	290
Teahan, Denis	July 1, 1914	155
Thacker, George	Sept. 12, 1913	62
Thompson, John	June 30, 1915	207
Thompson, Michael	July 27, 1917	375
Thomson, John	June 12, 1918	405
Tipton, William C.	June 1, 1914	140
Todd, Henry J.	July 15, 1916	328
Touhey, James	Dec. 1, 1914	188
Turnbull, Matthew	Sept. 27, 1917	384
Tully, Matthew	May 5, 1914	121
Tully, Thomas	May 5, 1914	122
Vardy, Robert	Sept. 12, 1913	61
Walker, George M.	Sept. 6, 1916	354
Wallace, George	April 29, 1918	403
Wallbank, John W.	June 1, 1914	127
Wallis, John	Nov. 1, 1915	231
Wardrop, James	June 30, 1913	30
Warburton, Leonard E.	Sept. 12, 1913	74
Watson, Adam G.	June 10, 1913	10
Watson, Arthur	Nov. 25, 1915	244
Watson, Joseph	June 22, 1916	310
Waugh, Andrew W.	Jan. 26, 1916	288
Weeks, John	Jan. 26, 1914	109
Wesnedge, William	Sept. 12, 1913	50
White, William	June 10, 1913	21
Whitehouse, William	Dec. 12, 1914	196
Wilcox, J.	Sept. 12, 1913	58
Wilkinson, George	June 12, 1918	404
Wilkinson, Edward	Jan. 26, 1916	258
Williams, John S.	June 12, 1918	407
Williams, Thomas H.	June 10, 1913	3
Williams, Watkin	June 1, 1914	138
Williams, William D.	Jan. 28, 1916	299
Wilson, Thomas	Nov. 1, 1913	84
Wilson, William	June 10, 1913	8
Winstanley, Henry	July 27, 1917	376
Worthington, Joseph	Sept. 2, 1913	40
Wright, John	June 22, 1916	316
Yarrow, George	Jan. 26, 1914	112
Young, Joseph	July 15, 1916	322

FIRST-AID WORK.

REPORT OF DUDLEY MICHELL, FIRST-AID INSTRUCTOR.

I have the honour to submit herewith a report on the first-aid instruction in the coal and metalliferous mines of the Province for the year ending December 31st, 1918.

During the year approximately 200 mining employees attended a course of lectures on first-aid work given by the various mine doctors. The total number passing final examinations and who were awarded certificates of various grades issued by the St. John Ambulance Association is placed at ninety-four. The location of the class, number attending lectures, and number passing final examinations is as follows:—

Place.	Passed Examinations.				Total.
	First Year.	Second Year.	Third Year.	Fourth Year.	
Nanaimo	27	4	2	2	35
Cumberland	1	..	1	..	2
Fernie	10	3	2	..	15
Michel	4	..	5	2	11
Corbin	7	2	..	..	9
Anyox	16	.	..	..	16
Kimberley	6	..	..	..	6
Totals	71	9	10	4	94

From the commencement of systematic first-aid training in the mining centres of the Province until the close of 1918 there have been 944 mining employees who have passed examinations in this work.

Upon your instructions, I commenced taking mine-air samples in each operating mine of the Vancouver Island and Nicola coal-mines on March 1st. These samples were taken periodically, and much information was obtained as to the gas-outflow, etc. Statistics on same have been prepared and submitted to you. During 1918 I have taken 226 mine-air samples.

EXPLOSION IN No. 3 MINE, COAL CREEK COLLIERY, APRIL 5th, 1917.*

Report by George Wilkinson, Chief Inspector.

I have the honour to submit the following additional report on the explosion which occurred in No. 3 mine, Coal Creek Colliery, on April 5th, 1917, resulting in the loss of thirty-four lives:—

At the time of the examination made immediately after the occurrence of the explosion, the general opinion was, with which the writer agreed, that the force of the explosion originated in the levels inside of No. 6 incline and split at the foot of No. 6 incline. A part of the same travelled up No. 6 incline, splitting again at No. 1 room off No. 6 incline, a part going up the incline and a part into No. 1 room up crosscut and into No. 2 room; up the crosscut to No. 3 room; out of No. 3 room and going again on No. 6 incline into Nos. 4 and 5 rooms and No. 6 incline. This force broke the stoppings between Nos. 5 and 6 inclines and passed direct through to No. 4 Incline district. The other part that went into Nos. 5 and 6 inclines made conflicting lines of force, but eventually joined up with forces going into No. 4 Incline district. Nos. 5 and 6 inclines and Nos. 4 and 5 rooms being practically blind ends or culs-de-sac, conflicting lines of force could be expected at this point. The forces going through No. 4 Incline district came down Nos. 3 and 4 inclines, joining the forces from Nos. 5 and 6 inclines, and were outwards from that point. All lines of force on the counter-level were outward, going up crosscuts at some places on to the Main level.

In my former report, under the heading of "Deductions as to the Initial Point of Explosion," I stated as follows: "The lines of force as found in the mine seem to indicate that the point of origin was somewhere inside of No. 6 incline. As to where inside of this point the explosion originated it is premature as yet to decide, but, personally, I am inclined to think there was a primary explosion of fire-damp within this area which was propagated through the mine by the agency of coal-dust."

From the additional evidence found, I have no reason to change the opinion then stated, but believe that the actual point of ignition can now be accepted as having taken place at the face of the crosscut off the counter-level.

Conditions found at Foot of Nos. 5 and 6 Inclines and from there into Faces of Level, Counter-level, and Crosscut off Counter-level.

During the recovery-work at the bottom of Nos. 5 and 6 inclines the bodies of Drivers Richardson, Baggioli, Evans, McDougall, and Clarkstone were found, and conditions show that the most of the damage done to the cars seems to have been done by a force which came from the inside of the level, the upper structure of the empty cars being all stripped and thrown outwards.

Three of the bodies recovered at this point had their heads pointing outwards, two of which were lying on their faces. The body of Richardson seems to have been half-turned around, as if he had been thrown outward, his head behind the loaded car, which he seems to have been assisting Baggioli to push down to the loaded trip. Clarkstone, who was holding two horses and was standing on the empty track, seems to have been looking towards the face of the level; he was holding his own horse and Baggioli's, his own horse being attached to an empty car. The custom was for each driver to take an empty car out to the foot of the slope, so as to get a ride out. Clarkstone, who was severely burned, all the clothes being stripped off the body from the knees to the shoulder, was found with his left arm up and over his eyes as if to protect them, his mouth open and tongue protruding; and while there were indications of burning on the other three bodies, Richardson, Baggioli, and Evans, none of them was so severe as with Clarkstone. McDougall's body was found lying about 10 feet inside of No. 6 incline, doubled up with a heavy timber across the shoulders, pressing the head down so that the face was resting on the chest, head and feet both pointing outward. It seems as if the horse must have been blown outwards and out of the shafts, the driver being thrown into the position occupied by the horse and the falling timber held the body there. McDougall's horse was found lying across the loaded track, head pointing inwards, while its collar was found about 12 feet farther inside.

Lamp No. 3449 was broken into two separate pieces. The bottom was found beside the first empty car 5 feet inside from McDougall's body, the top on the base of the second car. This

* Special preliminary reports on this explosion by Geo. Wilkinson, Thos. Graham, and Jas. Ashworth were published in an appendix to the Report of Minister of Mines for 1917.

lamp was issued to Driver Evans and McDougall's lamp was found with Evans. The woodwork on the empty cars was completely smashed, but very little damage was done to the loaded cars.

The bodies of Puillandre and Redoulez, the two miners who worked in the Main level, were found on their way out at a point about 500 feet from their working-face; both bodies were found lying on their backs, head pointing outwards, and were stripped of clothing, apart from two pieces of overall, very little indication of clothing being found.

One safety-lamp was found with these men and was found broken in two separate pieces. The bottom was found on the high side of the roadway, 13 feet inside of Puillandre and 4 feet inside of Redoulez, and the top frame 28 feet farther inby. The gauzes were found outside the top part and 6 inches away.

The trap-door in the haulage-road crosscut, which was variously estimated as being from 20 to 30 feet off the Main level towards the counter, presumably had been blown upwards, as the only portion found was one hinge and one socket; these were found at the top of the crosscut practically on the Main level. The evidences of force from the position of timbers is conflicting, some being outward and some inwards.

Proceeding in the counter-level, about 10 feet from the edge of the caving a shirt was found, and at the edge of the cave two sets of tools; then two dinner-pails; and on the right side going in, a rail-bender and safety-lamp.

At the foot of the crosscut, with his head towards the frog pointing outwards, the body of William Brown was found extended at full length, face downwards, and arms stretched forward.

At the face of the counter a car was almost loaded and off the track at the front end, and on the inside the body of Joe Bravin was found, lying between the floor-brushing and the car. Under the body was a saw-blade, while the handle was found a little nearer the face, and a safety-lamp was found beside the car-wheels on the raise side. This lamp was issued to Brown and the one inside of the rail-bender was issued to Bravin. At the face of the counter there was loose coal, as if the miners had loosened enough to complete the car, and their shovels were both sticking in the loose coal, as if they had been loading the loose coal when the explosion occurred. A pick lay on each side of the place and the axe was on the low side near the pick. A cap was found on the loose coal and one set of timber was lying on the floor, as if it had been blown out. Everything in and around the place was heavily coated with coked coal-dust, especially on the inside of the car; this was adhering very heavily to the car and could be lifted off in handfuls.

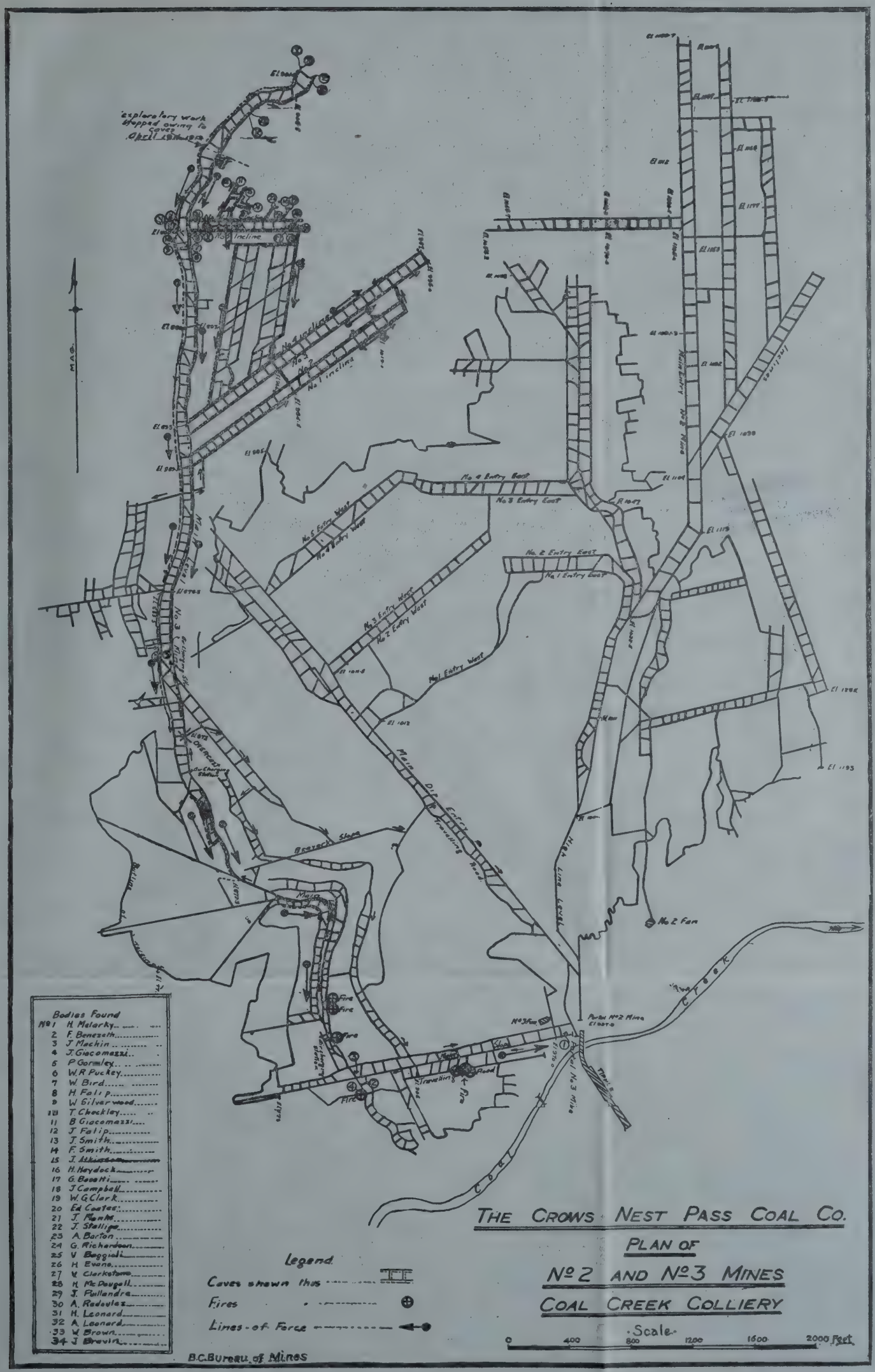
At the foot of the crosscut the bridge-stick seemed to be swung on the inside end towards the face of the crosscut, and two sets were out. Brattice-cloth was found driven into the pack-wall on the low side of the crosscut.

About 60 feet from the bottom of the crosscut Hector Leonard was found, lying on the right side of the crosscut, face downwards, head pointing outwards; his tools beside him, consisting of shovel, axe, and pick. The body was lying in the centre of the track and the tools were lying on the left-hand side of the body going up the crosscut; his dinner-pail and drinking-flask were also found on the side at this point, and a little nearer the face his coat was found.

The car was loaded, and lying between the car and the brattice on the right-hand side was another set of tools, which it is presumed belonged to August Leonard, consisting of one pick on a handle, two loose blades, a shovel, and a saw; a little farther on was a safety-lamp, No. 1349, also between the car and the line of brattice-cloth, with a hole punctured in the upper part of the glass. About the same place, but nearer the rib, lamp No. 1350 was found, standing upright and in apparently good condition, as if it had been placed at the end of the brattice to cool.

August Leonard was found lying between the car and the face, 8 feet 6 inches from the face and about 2½ feet from the car, head against the rib, resting on his right arm and face downward, with his legs drawn up, very suggestive of trying to protect himself. The place was cleaned up, no loose coal, and was timbered close up; the brattice was 12 feet 2 inches back from the face, and about 8 feet of it was still hanging. A coat was also hanging on a nail between the car and the rib, at a point where the brattice-cloth ended. August Leonard's cap was found lying near the car on the same side, and Hector's a short distance on the outside of the body.

Evidence of slight coking seemed everywhere, on sides, roof, car, and floor, but it seemed to be more pronounced on the rib nearest to where the lamps were found.


Bodies Found
No 1 H. Malarky
2 F. Benezeth
3 J. Machin
4 J. Giacomazzi
5 P. Gormley
6 W.R. Puckey
7 W. Bird
8 H. Falip
9 W. Silverwood
10 T. Checkley
11 B. Giacomazzi
12 J. Falip
13 J. Smith
14 F. Smith
15 J. Atkinson
16 H. Haydock
17 G. Bocatti
18 J. Campbell
19 W.G. Clark
20 Ed. Coates
21 J. Monk
22 J. Stellige
23 A. Barton
24 G. Richardson
25 V. Baggiali
26 H. Evans
27 V. Clarkstone
28 H. McDougall
29 J. Pallandre
30 A. Radovlez
31 H. Leonard
32 A. Leonard
33 W. Brown
34 J. Brevin
Legend
Caves shown thus
Fires
Lines of Force
THE CROWS NEST PASS COAL CO.
PLAN OF
No 2 AND No 3 MINES
COAL CREEK COLLIERY
Scale
0 400 800 1200 1600 2000 Feet
B.C. Bureau of Mines

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OF THE
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The caving extended to within a few feet of the Main level, but there was no unusual condition found at that point; while there was a heavy deposit of soot, there were no signs of coking.

Lines of Force of Explosion Inside of No. 6 Incline.

The lines of force from No. 6 incline for some distance in were conflicting, but in the writer's opinion this was caused by the recoil blast. The first evidence of a confliction in the lines of force is found at McDougall's horse, which was lying across the loaded track, head pointing inside, while the collar belonging to it was found about 12 feet inside. In the case of the safety-lamp found with Puillandre and Redoulez, this was found broken in two pieces; the first part found was the bottom of the lamp on the high side, 13 feet inside from Puillandre's body and 4 feet inside of Redoulez; the top part, including shield, 28 feet farther inside. The gauzes were outside the top part and were found 6 inches farther outside.

In some of the crosscuts very distinct evidences of an outward blast was found, the tops of the posts having been broken off and having a distinct leaning towards the counter-level.

In the haulage crosscut the only indication found of the trap-door which stood in this crosscut was one hinge and one socket, which was found at the top of the crosscut on the Main level, whereas the door stood from 20 to 30 feet off the level. The bridge-stick at the foot of the haulage crosscut, on which the check-curtain was fastened, was found inby from its original position and almost round a right-angled turn. A little farther inside on the counter-level on the low side stood three posts, one practically vertical, the other two showing a decided leaning outwards. In the ventilating crosscut there was evidence of conflict of forces, as shown by some posts leaning towards each other.

The brattice-cloth which had been erected in the level and up the crosscut was completely destroyed, with the exception of about 8 feet at the face of the crosscut. Small remnants of the brattice was found sticking on projections on the sides along the stone pack on the low side of the roadway, and at the bottom of the crosscut it was found driven into the pack-wall, which showed unmistakable signs of it having been carried by force down the crosscut and driven in the pack-wall.

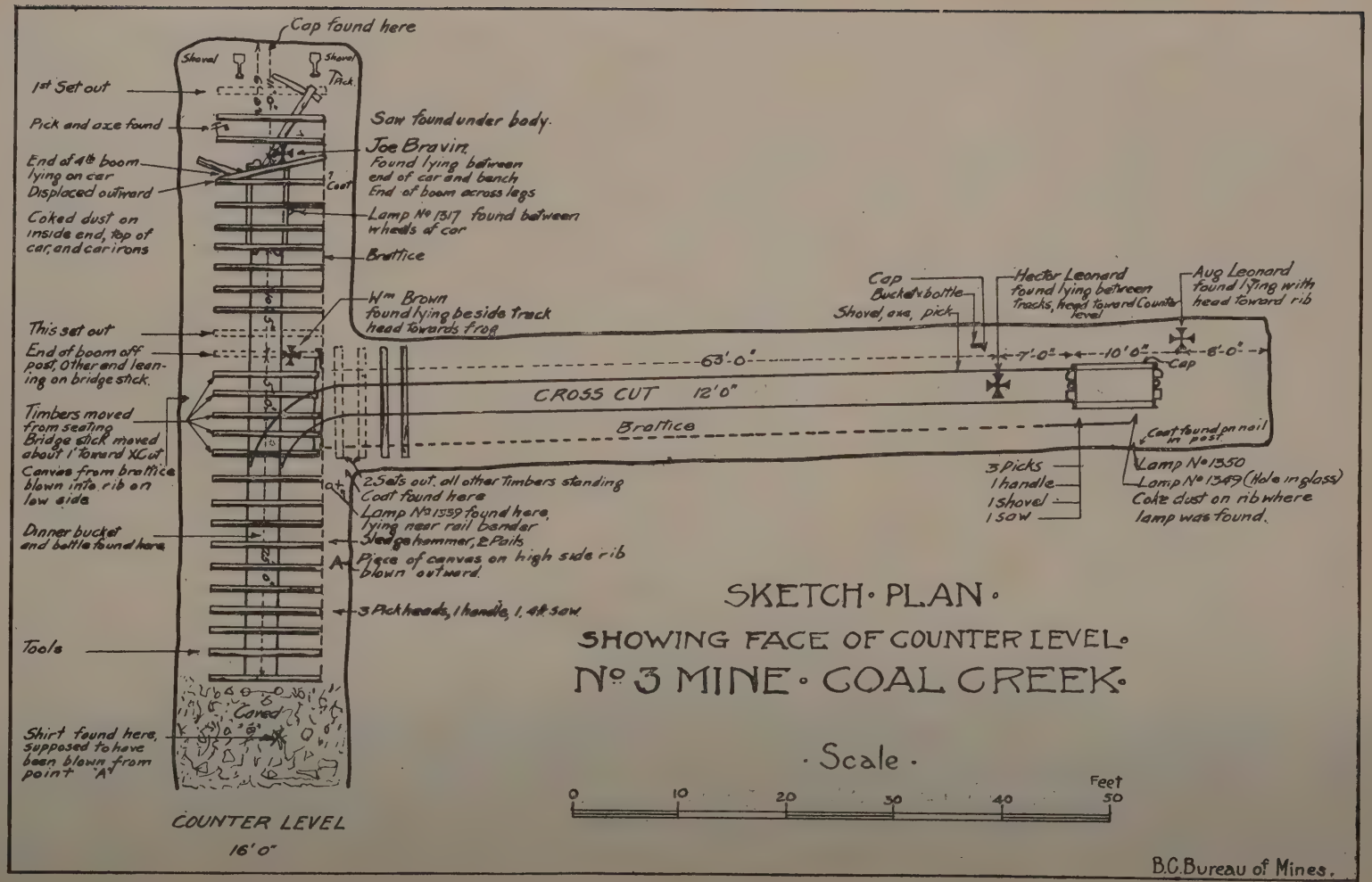
At the foot of the crosscut of the counter-level the bridge-stick seems to have been swung on the end towards the face of the crosscut. The next two sets were out; one set was lying right across the crosscut and the other at right angles to it. With this exception little damage was in evidence.

In reviewing the evidence of force, the writer must come to the conclusion that first blast was outward. Regarding conflicting force, where the horse was turned around and the collar blown inwards, in the writer's opinion this was done by the return blast down No. 6 incline, or in the recoil blast of the explosion. There must have been an outward blast in the first place to blow the horse out of the shafts. The driver was found in the position where the horse should have been, right between the shafts, so it would appear that prior to the occurrence of the explosion the horse had been standing attached to two cars, and in all probability the driver had been sitting on the front of the first car, and in the first outward blast the horse had been blown clear out of the shafts and the driver had been blown off the end of the car in between the shafts, and a set of timber had fallen on him, pinning him there, or in all probability he would also have been moved by the second blast.

It is conclusive in the writer's mind that no inward force could have blown the horse out of the shafts into the position it was in. There must have been an outward force to first blow it clear of the shafts. The inward force, as shown by the scattered pieces of the lamp, are also from the same force that turned the horse around.

Deductions as to the Initial Point of the Explosion.

It will be necessary here to review the conditions of the mine prior to the explosion. From March 1st to April 5th, 1917, the day of the explosion, there were ninety-six fireboss reports entered in the book, and on eighty of these gas was reported. This was reported mostly as a cap of gas in return air from face of level to face of counter-level. From evidence brought out by the witnesses at the inquest, it was proved that this was from a ½- to ¾-inch gas-cap. From experimental tests made since the occurrence of this explosion, it has been demonstrated that a ¼-inch cap represents 2½ per cent. of methane. From this it may be assumed that the ventilation in the counter and crosscut must have been continuously bordering on the danger-line.


Cap found here
Shovel
Shovel
Pick
1st Set out
Pick and axe found
Saw found under body.
Joe Bravin
Found lying between end of car and bench
End of boom across legs
End of 4th boom lying on car
Displaced outward
Coat
Coked dust on inside end, top of car, and car irons
Lamp No 1317 found between wheels of car
Brattice
Wm Brown
found lying beside track
head towards frog
This set out
End of boom off post, Other end leaning on bridge stick.
Timbers moved from seating
Bridge stick moved about 1' toward X Cut
Canvas from brattice blown into rib on low side
Dinner bucket and bottle found here
Tools
Shirt found here, supposed to have been blown from point "A"
Cap
Bucket & bottle
Shovel, axe, pick
Hector Leonard
found lying between tracks, head toward Counter level
Aug Leonard
found lying with head toward rib
63'-0"
7'-0"
10'0"
8'-0"
Cap
CROSS CUT 12'0"
Brattice
Coat found on nail in post
3 Picks
1 handle
1 Shovel
1 saw
Lamp No 1350
Lamp No 1349 (Hole in glass)
Coke dust on rib where lamp was found.
2 Sets out, all other Timbers standing
Coat found here
Lamp No 1339 found here, lying near rail bender
Sledge hammer, 2 Pails
Piece of canvas on high side rib blown outward.
3 Pick heads, 1 handle, 1 4ft saw
A
Caved
COUNTER LEVEL
16'0"
SKETCH · PLAN ·
SHOWING FACE OF COUNTER LEVEL ·
No 3 MINE · COAL CREEK ·
· Scale ·
0
10
20
30
40
50
Feet
B.C. Bureau of Mines.

Mr. Lane, who worked in the Main level, stated in his evidence given at the inquest that on the morning of April 5th, when he went in his place, there was a ½-inch gas-cap in it, and this was gradually increased to ¾ inch at the end of the shift. He also stated that this was no unusual condition since the double shift was put on. (The double shift was put on to place the men thrown out of work by the "bump" in No. 1 East mine last November.) He also admitted that Inspector O'Brien had withdrawn him owing to there being a 1-inch cap of gas in the air. Lane, who is an old experienced miner, had worked for many years as fireboss.

R. Dodson, bratticeman, claimed he went into the Main level that morning and found a small cap of gas about ½ inch.

J. McCourt, fireboss on the night shift, gave evidence that he found a small cap of gas in the crosscut off the counter-level, which he reported.

John Biggs, overman of No. 3 mine, testified that he visited Lane's place on the afternoon of the day of the explosion and examined for gas, and only found a ½-inch cap.

Of samples of mine-air taken on March 23rd, 1917, one taken 150 feet on the return side of the counter-level showed 3.43 per cent. and one taken 500 feet from the face of the Main level showed 1.99 per cent. As a fact, we have the Main and counter levels showing from 2 to 3½ per cent. continuously. Lane states that conditions got worse towards the end of the morning shift the day of the explosion, and it is safe to assume that conditions were yet worse in the counter-level and crosscut of the counter-level; and if they got worse from 7 a.m. until 3 p.m., it is safe to assume that conditions got still worse by the end of the afternoon shift. The long brattice on the crosscut off the counter makes it the weakest link in the whole ventilating system, and it can be assumed that in all probability there was a thin stratum of explosive gas along the roof at the face of the crosscut.

The indications in the counter-level are that the two miners, Brown and Bravin, were busily engaged loading a car, and evidently working with one lamp, the other apparently having been extinguished and placed behind the brattice to cool. The fact that these men in the counter-level were loading a car would naturally create a cloud of dust.

In the crosscut the two miners, Leonard brothers, had apparently completed the loading of the car and had put up a set of timber. They had evidently been working with one lamp, the other lamp having been placed at the end of the brattice to cool. From the appearance they had evidently decided to finish the shift and were putting back their tools; Hector going first, carrying his tools in the dark, and his brother, Augustus, following down with his tools and carrying a lamp. Apparently, in passing through the narrow space between the car and the brattice, the glass in the lamp carried by August Leonard got punctured by coming in contact with some sharp instrument, presumably the point of a pick.

It is the opinion of the writer that this is the point of origin of the explosion, and what took place is about as follows: August Leonard was in the act of carrying back his tools. Having too many he probably stumbled, and one of the pick-points struck and penetrated the glass. It would seem probable Leonard heard the pick strike the glass, dropped his tools, and raised his lamp to see what damage was done, raising it high enough to reach an accumulation of explosive gas along the roof of the place, so igniting the same, thereby causing the primary explosion. There is no doubt but that it would have been only a local inflammation of gas if the condition in the other places had not been so ripe for the propagation of the explosion throughout the mine.

Once the explosion was started, there was sufficient dust to propagate it the length of the crosscut to the counter-level, where the miners were loading a car, which would make a very dust-clouded atmosphere at that point. This theory is borne out by the amount of coking deposited in this place.

The dust must have been very pure at this point, as is demonstrated by the amount of coke adhering to the surface of the car. The explosive wave had apparently travelled from the counter out and up the ventilating crosscut to the face of the Main level; from here outward it had travelled on both the Main and counter levels, until the wave had been checked in the counter by lack of material to carry it along. This occurred when it reached the swamp in the counter-level, which was about opposite Nos. 5 and 6 inclines. From No. 6 incline out, the path of the explosive wave was as stated in my former report.

In outlining the above theory for the initial point of the explosion, three important points have been kept in mind: First, to have an explosion there has to be material to explode; second,

there has to be a means of ignition; third, there has to be material necessary to propagate the explosion through the mine. All of the above can be found in the counter-level and crosscut off the counter-level. From evidence given at the inquest it was brought out that almost continuously for thirty days there had been from a ½- to ¾-inch gas-cap present in these places. At the time of the inquest it was taken that a ½-inch gas-cap would equal 2 to 2½ per cent. From experiments made since in measuring flame-cap, and taking samples for analysis and checking with the Burrell gas-detector, it has been proven that a ¼-inch cap on the Wolf safety-lamp is equivalent to 2½ per cent., and that a ½-inch cap equals about 3½ per cent.; so, if the evidence of the miners is to be credited, that if there was a ¾-inch cap at the end of the morning shift, there must then have been upwards of 4 per cent. in the current.

It appears that Inspector Williams was fully alive to the dangerous conditions existing in the Main and counter levels of No. 3 mine. In a letter to Manager Caufield dated March 26th, 1917, he draws attention to conditions on the 23rd as showing a ¾-inch gas-cap in the air-current of the Main and counter levels of No. 3 mine, and stating this quantity of gas is altogether too much for operations to be carried on safely, and requesting that steps be taken immediately to improve the ventilation, and while this was being done, that only one shift of eight hours out of the twenty-four could be worked in these places.

According to evidence given at the inquest, the explanation was given that this ¾-inch cap was due to some door being broken and the ventilation being deranged. In the writer's opinion this ¾-inch cap was not due to the disarrangement of the ventilation, for the simple reason that a mine-air sample taken the same day in the intake to these places showed 1.99 per cent. of methane. From the above it can be seen that conditions must have been ripe for an explosion at times in this particular area, and that all that was needed was a means of ignition, and this was readily supplied by the broken safety-lamp of Augustus Leonard. The peculiar position in which Augustus Leonard was found suggested that he had recoiled from some danger after throwing down his tools and lamp.

The position of Brown in the counter would indicate that he was startled, and saw or heard some alarming condition and made an attempt to escape. His partner, Bravin, also made some attempt to get out, and had got tangled up with the saw and fell between the brushing and the car. These seemed to be the only two men in the mine, beside Augustus Leonard, who had moved, and in the writer's opinion they had heard the noise in the crosscut when the explosion started and had made an attempt to escape. In all probability the initial explosion or flashing would be slow, and Brown is the only workman who had moved any distance, all the other workmen being caught where they were, showing that after the explosion did get started and caught up the dust in suspension from the loading of the car in the counter-level it travelled very quickly. After carefully reviewing all the evidence, I have come to the conclusion that this explosion originated in the crosscut off the counter-level, and was primarily an explosion of gas ignited by the flame in the broken lamp carried by Augustus Leonard. This explosion travelled down the crosscut and was augmented by the dust in suspension from the loading of a car in the counter-level, and was thus propagated throughout the mine-workings by the agency of coal-dust.

Appended to this report is a plan of No. 3 mine, showing position of bodies and general lines of explosive blast and direction of ventilating-current; also detailed sketches of position of bodies at foot of Nos. 5 and 6 inclines and face of counter-level and crosscut and Main level; also list of lamps found in recovery-work from Nos. 5 and 6 inclines in, and condition of lamps as far as ascertained.

SAFETY-LAMPS RECOVERED IN NO. 3 MINE, COAL CREEK.

Lamp No. 3508.—Spare lamp, found inside of South slope landing in empty track, 10 feet from lamp No. 579 measured diagonally alongside motor. Glass smashed; top seemed loose; one small piece of glass in place; gauzes in place; striker all right.

Lamp No. 579.—Spare lamp, found inside end of South slope landing on loaded track, 16 feet from frog near motor. The above two lamps would be in use by the motorman and conductor.

Lamp No. 3450.—Issued to G. Richardson, found hanging on his belt. Shield has hole 1 x ¼ inch and is bent inward on one side; brass shield slightly tarnished (green); iron parts rusty; not opened. Recovered in November, 1917.

Lamp No. 3454.—Issued to V. Baggioli, found underneath his right arm; November, 1917. Hole 1 x ½ inch in shield; glass broken, some of glass projected up into gauze, and lower gauze-

ring displaced; fragments of brattice-cloth adhering to shield; small dent in lower gauze-ring; lamp coated with mud, as if been lying in either mud or water; not opened.

Lamp No. 3448.—Issued to B. Clarkstone, found between tracks alongside where body was found; November, 1917. Lamp seemed intact, except for small dent in top ring of shield; not opened; striker all right.

Lamp No. 3441.—Issued to B. McDougall, found with body of T. Evans on left side of loaded track and just inside where lamp No. 3454 was found; November, 1917. It was covered with mud, which had hardened on the lamp; the cover over the magnetic lock was broken off at the two rivets; shield tarnished (green); bottom and handle rusty; one of the glass standards bent inward, touching the glass; striker jammed; lamp seemed to have been lying in mud or water; not opened.

Lamp No. 3449.—Issued to Thos. Evans, found near body of McDougall; November, 1917. This lamp was smashed; bottom was found 5 feet inby where McDougall was found, and top inside an empty car 11 feet inby where McDougall was found (second empty car). Only one of the glass standards was attached; no rust; three severe dents in bottom; one of gauze standards reversed (probably done by workmen when lamp was recovered); striker all right.

Lamp No. 1038.—Spare lamp, found near body of A. Redoulez; March, 1918. Bottom found 4 feet inby body, top shield and frame 28 feet farther in, and gauze 6 inches outby from shield and frame; glass and three of the standards missing; bottom seems all right; striker same; hole in top shield, which was smashed inwards in two places the whole length of the shield. The whole of the top shield except one part seems to have been subjected to heat; the part not affected seems to have been protected by contact with the ground, as there is a yellow deposit on it. This lamp was found wedged tight between two timbers.

Lamp No. 1364.—Issued to E. Coats, found at entrance to crosscut off No. 6 incline in front of loaded car; March, 1918. Lamp intact, only shield dented a little; fragments of brattice-cloth and coked coal-dust driven into and adhering to upper shield; ring-plate depressed on one side; bottom rusty; striker all right; lamp not opened.

Lamp No. 1375.—Issued to J. Campbell, found at face of crosscut off No. 6 incline in centre of place; March, 1918. Glass of this lamp is broken and shield dented; some coked dust was found on shield of this lamp. Two pieces of the glass still in place; small coal and coked dust driven in and adhering to shield; striker all right; lamp not opened.

Samples of dust were taken from lamps Nos. 3454, 3448, 3450, and 1364, and a small portion of the shield from lamp No. 1038.

Lamp (No Check).—Found in No. 4 room, No. 6 incline; April 10th, 1918. Hanger and check missing; standards loose, as if lamp had been subject to abuse; upper shield forced inwards in two places; coked coal-dust practically in every opening of shield; glass sooty; piece of brattice-cloth stuck between glass and the standards of glass unbroken; striker in order.

Lamp (No Check).—Found at face of No. 5 room, No. 6 incline (supposed to belong to H. Haydock). Lamp in fairly good condition, although shield showed evidence of heating, and was slightly covered with coked coal-dust.

Lamp No. 1317.—Issued to Wm. Brown, found between wheels of car at face of counter and near the body of Joe Bravin. Lamp practically intact, except for a heavy coating of coked coal-dust; the shield seems to have been heated until all the brass coating had disappeared; some small pieces of brattice-cloth were adhering to shield, as if driven into the openings.

Lamp No. 1339.—Issued to Joe Bravin, found on bench outside crosscut off the counter-level, and about 10 feet outby where the body of Wm. Brown was found. Lamp was lying on its side; seems to have been subject to much abuse, as standards were loose; shield was ripped up for about 2½ inches and seemed generally loose; one side of lamp was especially heavily coated with coked dust, and the remarks *re* heating in lamp No. 1317 also apply here.

Lamp No. 1349.—Issued to August Leonard, found beside the car in crosscut, on its side, and between the brattice-cloth and car. Lamp showed evidence of much heat, a small bead of solder having run from beneath the maker's name-plate; the shield was coated with coked coal-dust, and there was a small hole in the glass near top and fractures extending to bottom.

Lamp No. 1350.—Issued to Hector Leonard, found near the last lamp, but sitting upright on the right-hand rib. Lamp seemed in fairly good condition, except for coating of coal-dust.

The lamps in the counter-level seemed to have been subjected to much more heat than those in the crosscut.

FATAL ACCIDENT, PROTECTION SHAFT, NANAIMO, SEPTEMBER 10TH, 1918.

REPORT BY GEORGE WILKINSON, CHIEF INSPECTOR.

I beg to submit the following report on accident which occurred at the Protection Island shaft at 7.15 on the morning of September 10th, 1918, when sixteen men lost their lives by the breaking of a hoisting-rope and the failure of the safety-catches to arrest the fall of the cage, and thereby allowing the cage to plunge to the bottom of the shaft, a distance of approximately 550 feet:—

DETAILS OF OCCURRENCE OF ACCIDENT.

On the morning of September 10th, at 7.45, I received a long-distance telephone call from Inspector of Mines John Newton, informing me that the hoisting-rope had broken at Protection shaft, allowing a cage to fall down the shaft with sixteen men on it.

Immediately on receipt of the news I made ready to leave for Nanaimo. Leaving Victoria on the 9 a.m. train, I arrived in Nanaimo at 12.40 p.m., proceeding to the Mine-rescue Station, and was informed that one body had been recovered. I immediately made preparation for proceeding to Protection Island shaft by descending No. 1 shaft and proceeding along what is known as No. 1 level. This level passes within about 300 yards of Protection shaft, by which it is connected with an incline. I arrived at Protection shaft about 1.45 p.m., and there met Mr. Hunt, general superintendent of the Western Fuel Company; Thomas R. Jackson, mine manager; David Brown, overman; Thomas Price, master mechanic, and many other officials; and John Newton, District Inspector of Mines. I was informed that five bodies had been recovered. The bodies were all very badly mangled, with the exception of the body of Robert Kelly, who appeared to have been thrown out of the cage on to the shaft landing.

The cage had broken through the landing at the Douglas seam, which is the landing used for handling the men, and had fallen a distance of approximately 70 feet to a disused landing of what is known as the Newcastle seam. The landing at the Douglas seam was made by 12- x 12-inch timbers placed across the shaft and planked over with 3- x 12-inch planking. The cage in its descent had sheared through this heavy timber, and, as might be expected, was a mass of crumpled iron and steel and was all tangled up with the chains and that part of the rope that had fallen with the cage. Out of this wreckage the bodies of the victims had to be recovered.

Protection shaft is situated on the southern end of Protection island and was formerly used for hoisting coal from what was known as Protection mine; shipping-wharves were also located at this point. Some years ago the hoisting of coal out of this shaft was abandoned, and all coal mined in Protection mine was hauled to No. 1 mine, making the one central screening and shipping plant at that point.

For a time Protection shaft was used only as a ventilating-shaft, but on the passing of the eight-hour law in 1904, this shaft, on account of its close proximity to the workings of the North side of No. 1 mine, was fitted up and used for lowering and raising the men from the North side of No. 1 mine. The men are taken across the bay on a large ferry which runs to suit the time of the different shifts.

The shaft is rectangular in shape and is divided into two hoisting compartments and well fitted for that purpose. The shaft is enclosed and used as a downcast shaft, the ventilation being produced by a blow-fan. The shaft is some 670 feet in depth and penetrates both the Douglas and Newcastle seams.

The hoisting and lowering of the men is done with duplex hoisting-engine with 30- x 60-inch cylinders and a drum 10 feet in diameter is used. The pulley-wheels are also 10 feet in diameter. Hoisting-ropes 1½ inches in diameter, with a breaking strength of approximately 80 tons, are used. The gross load when men were being hoisted is about 6,000 lb., giving a safety factor of approximately 25. The cages are strongly built and are equipped with safety-catches and detaching-hooks.

The only work performed by the hoisting equipment at this shaft, apart from the hoisting and lowering of men, is the hoisting of coal for fuel for the boiler plant at that point, which consists of from forty to sixty cars a day. Two cars are hoisted each trip, so this would mean from twenty to thirty trips a day. The number of trips of men each day would be about twenty-five, so the amount of work performed by the hoisting plant at this mine is very small.

On the morning of the accident six loads of men had been safely lowered, and the rope broke when the seventh load was about 150 feet down the shaft.

History of the Rope.

The rope which broke was manufactured by T. & W. Smith, Newcastle-on-Tyne, England, who have a world-wide reputation as manufacturers of high-class ropes. This rope was placed in use on the Protection shaft on March 6th, 1915, so up to the date of it breaking it had been in use three years six months and nine days.

Apparent Condition of Rope at the Time of the Accident.

A careful superficial examination did not reveal any broken wires; various measurements taken of the rope's circumference showed about $^{3}/_{16}$ shrinkage in circumference from dimensions of new rope, so that there was no evidence of internal corrosion or wear on the rope. The outer wires of the rope, apart from showing a slight flatness where coming in contact with the pulleys and drums, did not show any signs of external wear. At the break there was much evidence shown of internal corrosion, some of the inner wires being almost eaten away.

Some of the outer wires were very brittle and broke quite easily when bent, while others were tough and could not be broken by bending. The rope was in a very dry condition and did not appear to have been oiled for some time, although evidence given at the inquest by the ropemen and corroborated by the engineers stated that it had been oiled less than two weeks previous to the accident.

Condition of Shaft after Accident.

The writer, in company with the Hon. the Minister of Mines and Andrew Bryden, who was appointed by the Hon. the Minister of Mines to make an examination and to report on the accident, and Inspector Newton, and the jury empanelled, and Mr. Gilmour, of the Workmen's Compensation Board, visited the scene of the accident. A thorough examination was made of the shaft, and it was found to be undamaged, with the exception of a broken guide at the bottom of the shaft. This guide had evidently been broken by the side force of the shoes on the cage at the moment when the bottom of the cage hit the 12- x 12-inch timbers across the shaft. There was no evidence of the safety-catches having ever made any attempt to grip in any part of the shaft.

Coroner's Inquest.

The writer attended the various sittings of the jury empanelled to inquire into the cause of the death of Robert Kelly and fifteen others, and endeavoured by cross-examination of the witnesses to bring out all the evidence possible. After all the evidence had been given by witnesses called, Wm. Fleet Robertson, Provincial Mineralogist, was called, and was instructed by the Coroner to proceed to Montreal and take with him sections of the rope and have them subjected to tests and microscopic examinations to try and determine the cause of the failure of the rope. To also take with him samples of water collected from the shaft and oil used on the rope for lubrication. On December 16th, 1918, and January 14th, 1919, Mr. Robertson presented his report to the Coroner and gave opinions as to the cause of failure of the rope.

The jury, after hearing Mr. Robertson's report and evidence given by Mr. Price regarding testing of safety-catches, also evidence given by Mr. Brown, an expert on wire ropes, retired, and after three hours' deliberations rendered the following verdict:—

"We, your Coroner's jury empanelled to inquire into the death of Robert Kelly and fifteen others in Protection shaft of the Canadian Western Fuel Company on September 10th, 1918, find that said men came to their death by descending on a defective cable which broke owing entirely to the oxidizing of the wires, chiefly caused by apparent absolute lack of any external* lubrication, leaving the wires thus exposed to the action of the more than normally corrosive water and humid atmosphere. In view of the evident general unreliability of exterior-lubrication measures, which from the evident adduced failed to preserve to any appreciable extent the life of said cable or preclude against deterioration, we suggest that the Department of Mines recommend the appointment of an expert inspector of hoisting-ropes, cages, safety-catches, and all appurtenances generally, and that legislation be enacted whereby, under such abnormal condition as obtained in said shaft, no new hoisting-cable be retained in service longer than some reasonable time to be determined by the Department of Mines, as otherwise there would appear to be no practicable process which can be adopted and absolutely relied upon looking to the absolute dependability of such hoisting-cables against defect or breakage under all present governing conditions.

"(Signed) M. C. Ironsides, *Foreman.*"

* *See* Report of Provincial Mineralogist on condition of ropes, page 354.

CONCLUDING REMARKS.

After listening to the various witnesses and to Mr. Robertson's very excellent report, and from personal observations, I must conclude that the failure of the rope was due to internal corrosion, and that the dangerous condition of the rope was not visible to a superficial examination, and would not be revealed by the common practice adopted for examining hoisting-ropes, but I cannot entirely agree with the causes as given for the internal corrosion.

There is not a humid atmosphere in Protection shaft; the shaft is used as a downcast, and there is practically no change from the outside atmosphere. Hygrometer tests taken at the top of the shaft, in the middle of the shaft, and at the shaft-bottom show the following results:—

	Humidity, Relative per Cent. of Saturation.
Test at top of shaft	84.0
Test half-way down	84.5
Test at shaft-bottom	87.5

Another point that has not been cleared up in my estimation is why the corrosion should be so much more at the point where the break occurred than at various points above and below the break. We have the rope standing a breaking strain of 55 tons 21 feet below where the break occurred, and 42 tons 10 feet above where the break occurred, and at a point 7 feet below the break it only stood a load of 13 tons. Again, 28 feet below the point of break it broke with a load of 25 tons. It has been suggested that the abnormal state of the rope at the one particular spot may be due to local conditions in the shaft. I cannot think of any local condition that may have been responsible for the excessive corrosion at this particular point.

An examination of the shaft does not disclose any unusual conditions at any particular point. Again, the hoisting-hope is never left in any particular position, so that if there were local conditions at any particular point the same part of the rope would not be exposed to these conditions at all times.

A rope of similar make and size in use at this shaft and in the same compartment is in use five years and twenty-two days, and since that time has been coiled on a reel and standing exposed to the elements for nearly four years, and after nine years does not show much signs of corrosion. This would lead to the conclusion that the conditions in the shaft were not entirely responsible for the corrosion, and would also lead to the belief that lack of lubrication was not the entire cause of the internal corrosion. The writer is of the opinion that something may have crept into the manufacture of the rope at certain parts which has made it more susceptible to corrosion than others.

After the failure of the safety-catches to come into operation upon the breaking of the rope, the Hon. the Minister of Mines ordered a series of tests to be made of their efficiency. These tests were made and are fully dealt with in a separate report. In the evidence given at the inquest a very conflicting state of affairs was disclosed regarding the daily inspection of the rope as required under section 91, "Coal-mines Regulation Act," chapter 160, General Rule 36. The person whose duty it had been to examine the rope daily had left his position nine days before the accident, and his helper had taken the job and was supposed to be making the examination of the rope. He testified that he had examined the rope every day since he had been on the job, but admitted under cross-examination that he had not examined the whole length of the rope, but only about 40 feet of it. Yet his report left the impression that he had examined the whole length of the rope. The rope had been carefully examined weekly by James Menzies, rope inspector for the company, a man with twenty-eight years' experience with wire ropes; his last examination being made on September 4th, six days before the accident. His examination consisted of carefully running the rope through his hands very slowly, looking for broken wires and noting any change in the diameter of the rope. A very minute examination had been made monthly, also, by James Gillespie and another party named Atherston. This monthly examination was made as follows: A few feet would be minutely examined, then the rope moved the distance examined, and so on by the same method until the whole rope had been examined.

It would appear that if there had been any visible flaw in the rope it would have been revealed by some of the examinations. Regarding the condition of a wire rope, this is a very hard matter to ascertain. If there are outward signs of wear a superficial examination will reveal it, but if there is an internal disturbance a general lessening of the diameter of the rope

is expected where the disturbance is located. Regarding corrosion in a rope, this is a hard matter to locate, and any of the known methods of examination are inadequate.

Several methods are suggested for ascertaining this condition, but the best of them is only a guess. A method adopted at some places is to recap the rope every six months, cutting a portion off nearest the cage and thoroughly examining it for corrosion and having it tested regarding strength. Another method suggested is to open the rope up to the centre by inserting a flat spike. Either of the methods may form a useful purpose, but they do not reveal anything as to what may be the condition of the rope apart from the particular part tested and examined.

Another method suggested is testing the rope with a heavy load, which is not, in the writer's opinion, a good practice, as it may subject the rope to a shock or a strain which may stand at the time, but may damage it so that it would break with a lighter load at some future date, thereby defeating the purpose for which it was made.

In the writer's opinion the best safeguard to prevent accidents from breakage of hoisting-ropes would be to place on the Statutes a provision limiting the length of time that hoisting-ropes can be used for raising and lowering persons, and to also provide for all ropes used for raising persons to be put through a hot bath of oil before being put in use.

Regarding the oiling of this particular rope, it is stated by credible witnesses that this had been done regularly every two or three weeks, and they expressed the opinion that the rope had been sufficiently oiled; but it is well known that if corrosion has started internally no outward application of oil or grease will arrest it, hence the necessity for a thorough saturation of the rope before being put in use, by means of a bath of hot oil; and the writer is also of the opinion that this should be done before the rope leaves the factory, as shipping of mining supplies is usually (on account of lower freight rates) by the water routes, which usually mean a sea voyage to Vancouver via China and Japan, whereby there is a chance, if the rope should get wet, of internal corrosion having started before the rope reaches its destination, providing no bath has been given at the factory.

PROTECTION ISLAND DISASTER, SEPTEMBER 10TH, 1918.

INVESTIGATIONS AS TO CONDITION OF CABLE.

REPORT TO THE CORONER BY WM. FLEET ROBERTSON.

On September 14th I appeared before you in the Court-house at Nanaimo, and, having taken the customary oath, I promised to give true evidence in the case before you—an inquest into the cause of the deaths of Robert Kelly, John Turner, and others on September 10th, 1918—to the best of my knowledge and ability. Being still under the obligations of the oath then taken, I make the following statement to you of facts as I know them:—

On September 14th, 1918, you gave into my charge certain exhibits, viz.:—

Exhibit No. 13.—A coil of 1½-inch wire cable, marked and described as being part of the hoisting-cable, the breaking of which was the immediate cause of the fatalities in Protection Island shaft on September 10th, 1918, into which you were inquiring. This exhibit is described in your letter of instructions as being from that portion of the cable which had constantly remained wound on the hoisting-drum in the engine-room at Protection island. The coil was marked with white paint for identification.

Exhibit No. 11.—A coil of cable described by you as being that part of the same hoisting-cable, including upper end of the fracture and extending upwards, as the rope would hang in the shaft, for a length of about 100 feet. The coil was marked with black paint for identification.

Exhibit No. 12.—A coil of cable described by you as being that part of the same hoisting-cable, including the lower end of the fracture and extending downwards, as the rope would hang in the shaft, towards the cage for a length of approximately 100 feet.

Exhibit No. 14.—Several used spiral springs described as having been in use on the cage at the time of the accident and recovered from the wreckage at the bottom of the shaft, designed to bring the safety-clutches into action.

Exhibit No. 16.—Two unused springs (spiral), evidently spare springs to be used for same purpose.

Exhibit No. 7.—A small fruit-jar of water said to have been collected as it fell in Protection Island shaft.

Exhibit No. 9.—A bottle of black oil said to have been such as the cable was supposed to have been lubricated with.

Of these exhibits, the coils of cable were carefully wrapped in burlap; the springs were crated in two boxes; and the samples of water and oil were taken by me personally and packed in a box. All these exhibits were delivered to the Dominion Express Company at Nanaimo and Victoria, directed to me in care of McGill University, Montreal, where I found them unopened and intact on October 1st, and identified them. To this extent all these exhibits have been in my personal charge and keeping, as directed by yourself.

I was directed by you to submit these exhibits to the most critical, physical, and microscopical tests practicable in Montreal, and to report to you when they were completed.

In conformity with your instructions, I submitted the coils of cable and the springs to the Physical Testing Laboraory of McGill University, which is under the direction of Professor H. M. Mackay, with S. D. McNab as Superintendent. I explained all the circumstances of the case as I knew them, and after consultation we applied all the tests that we thought would cast any light on the subject in question. These tests, which I personally witnessed, I shall describe in detail subsequently; and I also submit herewith the official report by Professor H. M. Mackay.

For microscopic tests, to see if possibly any crystallization of the steel had taken place, I had a sample cut from Exhibit No. 13 which I considered to be the normal condition of the steel as received from the maker, and another sample cut from above the fracture in Exhibit No. 11. These samples I submitted for microscopical examination to Dr. Stansfield and Gordon Spencer, an expert microscopicist, for critical examination.

I append their report, which speaks for itself, but I might here state that it shows that no injurious crystallization had taken place, which is as I expected, and which, while it is negative evidence, finally disposes of crystallization as a possible or contributing cause of the failure of the cable.

As regards the samples of water and oil, the Chemical Laboratories of McGill are so depleted by the war and we were so hampered by the opening of the session, and later by the "flu," that no work of this description could be undertaken, and upon the recommendation of the McGill authorities I took these to Dr. J. T. Donald, an analytical chemist of highest repute in Montreal, who undertook to do the work on these personally.

I might say that Dr. Donald is a graduate of McGill University and was for many years Professor of Chemistry in Lennoxville University, since when he has been in public practice as an analyst, and is doing the bulk of the chemical-work for the Imperial Munitions Board in Montreal.

I append Dr. Donald's reports on Exhibits Nos. 7 and 9, which showed that while the water was such as to have a decidedly corrosive action on steel wire, it was not unusually so. The oil was perfectly harmless.

TESTING LABORATORY.

Report on the Tests made in the Laboratory.

Before describing the tests in detail I will say a few words as to the Physical Testing Laboratory of McGill University. It is certainly the best-equipped testing laboratory in Canada for such tests; in fact, the only place where cable of this size could be broken. It is equipped with a large number of machines for testing strength, both tensile and compressive.

One large Wickstead 50-ton tensile-testing machine is exclusively used on Imperial Munitions Board work, and I was informed by Professor McKay that about 125,000 breaking-strain tests on shell-steel have been put through this year. This machine is hydraulically operated and is the most rapid and accurate on this continent.

The particular machine used in getting the breaking strength of the various samples of cable submitted by me is a Wickstead 100-ton single-lever machine made by J. Buckton & Co., of Leeds, England. The machine is capable of applying a breaking strain of 100 tons. It has been employed in testing a new 1½-inch steel cable made in Canada from English steel wire for the Shawnigan Company, and used as a span across the St. Lawrence river and having a length of 5,000 feet.

During my stay cables of 1¼ inches diameter were received from the Sudbury mines for testing, which, while apparently sound from surface indications, were found to be corroded internally.

Method of taking Samples of Cable for Testing.—In all instances the portion of cable selected for a test was carefully wrapped, very tightly, with special iron wire in two places, with about 36 inches of cable between the wrappings; this is the "test piece." At about 9 inches outside the wrappings the cable was cut through by an oxy-acetylene blow-pipe; the cut ends were then ground off on an emery-wheel to beyond the action of the blow-pipe. The 9 inches at each end outside the wrappings formed the attachment to the grip of the testing-machine.

Method of Attachment.—The grip is a steel cylinder about 8 inches outside diameter and 9 inches high. The interior of the grip is a hollow cone about 6 inches in diameter at the top and about 2 inches diameter at 1 inch from the bottom of the grip, the remaining 1 inch being a straight cylindrical hole to the bottom, 1⅝ inches in diameter.

The end of the test piece is passed up through the hole in the grip; the end of the test piece outside the wrapping is then opened up and each individual wire separated and the hemp centre cut out. The opened end of the cable is then immersed in gasolene to remove all grease. If the wires are free from rust (as was the case in Exhibit No. 13), then each individual wire is swabbed with half-strength hydrochloric acid; but if the wires are rusted, then full-strength commercial hydrochloric acid is used. If the wires are very rusty, they are rubbed bright with emery-cloth. The opened wires are then washed with very hot water and become dry. Each wire is then swabbed with "soldering-acid" (hydrochloric acid saturated with zinc).

The grip with the cable in place is held in a vice and the wires, somewhat straightened, are spaced equally throughout the conical cavity in the grip, leaving a clear annular space of about ½ inch next to the wall of the grip, the wires being held in place by smaller iron bands when necessary. Molten zinc is then poured into the grip-cavity around and among the wires until the cavity is full. The effect of this is that each individual wire is absolutely soldered in place into this cone of zinc and is immovable while the zinc cone becomes soldered to the surrounding grip. This method of attachment is that adopted and recommended by the United States Bureau of

Standards, and is in constant use at the McGill University Laboratory. Its efficiency is demonstrated by the fact that of the large number of ropes tested in the laboratory there has never been a wire budge and never has a cable broken in or at the grip.

TESTS APPLIED TO THE CABLE.

Exhibit No. 13.—Rope from off the Drum.

Construction of the Cable.—The cable consists of six strands wound around a hemp centre of about ¾ inch diameter. The pecularity of the "lay" of the rope is that the strands forming the cable are twisted in the same direction as are the wires forming the strands. All wires and strands are wound in the same direction. This is known as "Lang's lay." The strands seem to have been made by taking a straight soft-iron wire about 0.0865 inch in diameter, around which is wrapped or twisted six steel wires of an average of 0.0853 inch diameter, thus forming what might be called a *sub-strand*, around which is wound in the same direction nine wires of an average diameter of 0.1255 inch.

I submit for your inspection untwisted wires forming one strand, marked "A"; also the hemp core from the same piece of cable, marked "B." There was no means of distinguishing one end of this piece of cable (Exhibit No. 13) from the other. A test piece was cut from each end and one of these only was tested as to breaking strength, the result being conclusive. A short piece about 24 inches long was also cut and unwound, and the individual wires from this were tested for their individual tensile strength. The details of these tests are contained in Professor Mackay's report herewith, and show such remarkable uniformity in size and breaking strength as to speak very highly for the workmanship of the maker and for the material used.

This piece of cable (Exhibit No. 13) showed only very slight wear and only on the outer wires, possibly caused by pressure on the drum. The individual wires were bright and free from rust; the cable was practically as good as new and had been lubricated, grease oozing out as the strain was applied.

Test No. 1.—The test piece taken was approximately 36 inches between the grips. The load was applied in successive increments of 10,000 lb. each, the elongation of the specimen being taken for each increment. The elongation for each 5-ton increment was 0.04 inch up to 70,000 lb., increasing gradually until at 120,000 lb. the elongation for the last increment was 0.08 inch, the total elongation under this load being 0.59 inch.

At about 130,000 lb. the elastic limit of cable seemed to be reached, and the cable broke under a load of 160,000 lb., after sustaining such load for a minute or so, when three strands broke simultaneously a few inches below the upper grip. The pull being continued, the other three strands broke near the lower grip. The breaking strength of the cable was 160,000 lb., or 80 short tons.

As a check and confirmation of this test a 24-inch piece of the cable adjoining the test piece was unwound, the individual wires somewhat straightened, and six of the larger wires and three of the smaller wires from each strand were submitted to a tensile breaking strain. These wires are submitted and marked "C."

These wires showed remarkable similarity in strength. The wires of average diameter of 0.1255 inches had average strength of 2,540 lb.; the wires of average diameter of 0.085 inches had average strength of 1,165 lb. The aggregate strength of all the wires composing the cable if pulled straight would be 179,000 lb. The strength of the cable was therefore about 89.35 per cent. of the aggregate of the wires, a result considered as indicating a well-built cable. The tensile strength of the steel in the wires would be equivalent to about 208,000 lb. to the square inch. This result, taken with the uniformity in strength of the wires, indicates an excellent quality of steel in the cable.

Exhibit No. 11.—Section of the Cable immediately above the Fracture.

Test No. 2.—The test piece from this was cut starting about 5 feet above the tapered end of the fractured cable. The exterior of this exhibit showed a certain amount of wear on the outer wires, but not at all serious. No broken or torn wire ends were observed on the whole length of Exhibit No. 11 on the surface. A serious amount of rust was observable on surface wires.

On opening up the end of the test piece in preparing it for the grip, the smaller interior wires were found to be very badly rusted and eaten away, so much so that several of them were found to be completely eaten through. None of the larger (0.1255 inch in diameter) outer wires were eaten through, but they were also badly corroded, a rough estimate being that the steel

in these wires had about half the sectional area of similar wires in Exhibit No. 13 (the good rope). The cable and the core showed no indications of having been lubricated; both were dry and dusty.

This test piece, tested similarly to the former described Exhibit No. 13, showed very even elongation for each successive increment in 5 tons in load up to 60,000 lb., at about which point the elastic limit seemed to be reached. Under a load of 81,900 lb. four strands of the rope broke, the break extending 12 inches below the upper grip. In breaking, clouds of dust were given off, the doors of the building had to be opened to clear the air, indicating the interior to be very dry, with no indications of having been oiled. The two remaining strands broke under a load of 21,000 lb.

Exhibit No. 12.—Rope from the Fracture downwards towards the Cage.

Three separate pieces of this part of the rope were tested by breaking.

Test No. 3.—Test piece cut 11 feet from the end of exhibit nearest to the cage. This portion of the rope was seemingly uninjured by its fall with the cage. It was not untwisted at all and there were no loose or projecting wires on the surface. The surface was somewhat worn and was corroded to at least half-section of the externally visible wires. In the portion opened for the grip several of the smaller wires were found to be completely corroded through, as were a few of the larger wires.

The load was applied as in previous tests. With each 10,000 lb. increment of load the elongation was practically constant up to 40,000 lb. load, and was about 0.07 for each increment. At about 40,000 lb. certain of the interior wires were heard to break. At 49,400 lb. the cable broke at about 3 inches below the upper grip. The centre core was absolutely dry and dusty and large quantities of rust-dust were given off on breaking. Broken test piece submitted and marked "D."

Test No. 4.—A test piece from Exhibit No. 12 was cut 21 feet 6 inches below the fracture. The cable showed slight wear, but was much corroded, both on the surface and interior wires, and, as far as could be seen, few, if any, of the wires were actually eaten through. No evidence of lubrication was visible in the interior of the cable.

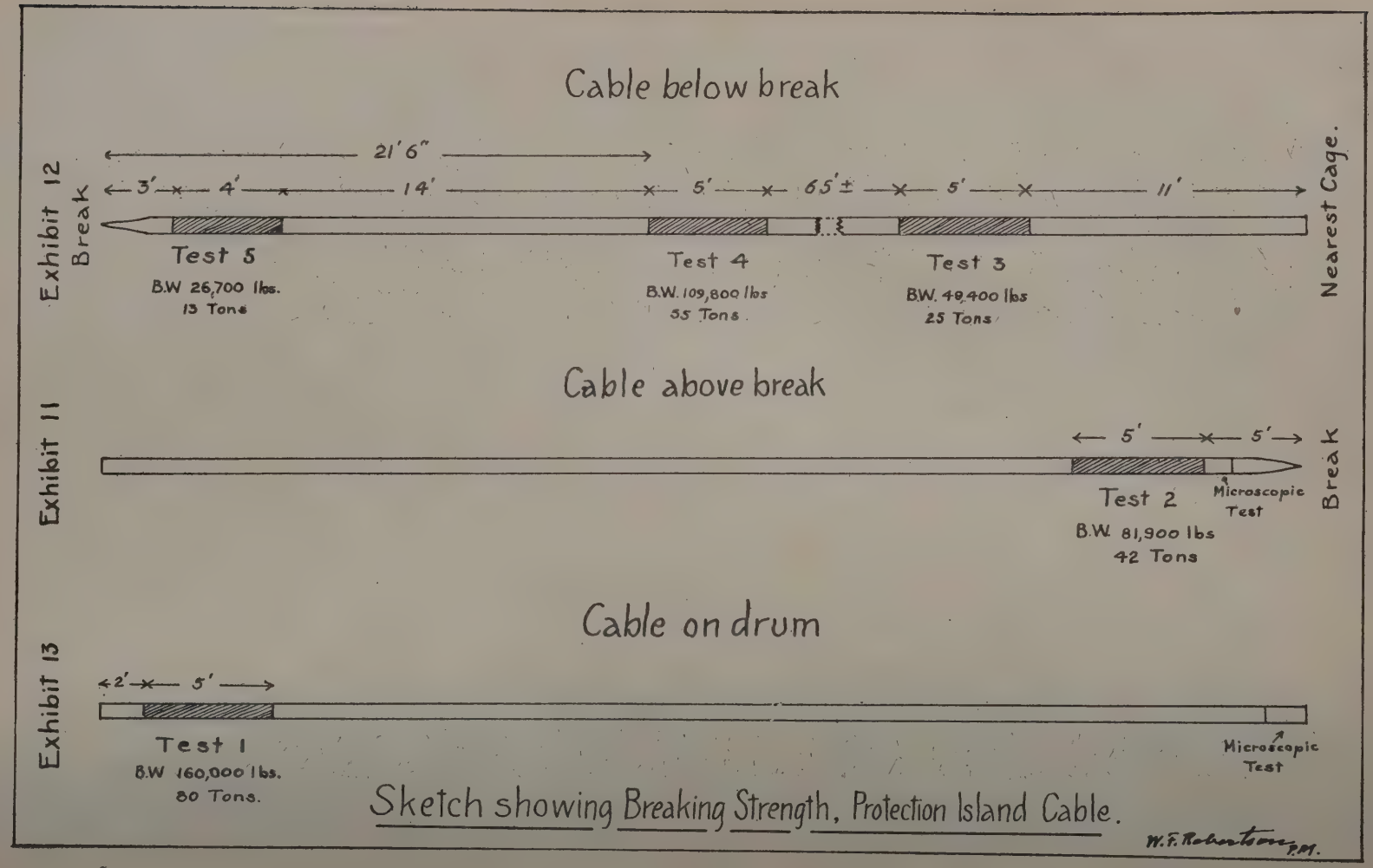
This test piece was treated as were the former tests. The elongation for each 10,000 lb. increment was constant at about 0.05 inch up to 80,000 lb., which was about the elastic limit. Under a load of 106,000 lb. some of the interior wires were heard to break. At 109,800 lb. the cable broke, two strands parting about 6 inches below the upper grip. Subsequently the remaining strands were broken by a reapplication of the load. The third strand broke under load of 55,000 lb.; fourth strand broke under load of 55,400 lb.; fifth and sixth strands broke under load of 43,700 lb. Three strands broke near each end of the test piece.

Test No. 5 on Exhibit No. 12.

Test piece was cut at 3 feet below the point of break. This test piece did not appear to have been damaged by the fall; the rope was still tightly twisted and but slightly bent, not enough to seriously affect it. This piece was badly corroded, so much so that even on the surface a number of the wires were seen to be completely eaten through and could be picked out with the fingers; none of the ends projected, however. In the interior of the cable one of the sub-strands was completely cut through by erosion. There were no indications that the rope had ever seen oil.

In opening up the two ends for the grip thirty-two wires were found completely eroded through and loose. The thirty-two wires I hand you herewith, marked "E." The condition of the test piece was evidently so bad that the load was applied in smaller increments than in the other tests. At 2,800 lb. load wires were heard to break in the interior. The successive loads applied were: 3,000 lb., 5,000 lb., 7,000 lb., 10,000 lb., when the elastic limit was reached at 20,000 lb. and 25,000 lb. At 19,500 lb. a number of wires were heard to break; at 22,000 lb. more wires broke; at 26,700 lb. load three strands parted 12 inches below the grip. The three remaining strands broke at 8,800 lb.

I submit herewith samples "F" and "G," which together make up the broken test piece. I also submit "H," the hemp cord from the same locality. I return to you sample "I," the lower end of the break as received from you. Also "J," the upper end of the break, which I have left unopened and which is as received from you. All the remaining parts of the exhibits entrusted to me I have returned to you by express.


Cable below break
Exhibit 12
Break
21' 6"
3'
4'
14'
5'
65' ±
5'
11'
Nearest Cage.
Test 5
B.W 26,700 lbs.
13 Tons
Test 4
B.W. 109,800 lbs
55 Tons
Test 3
B.W. 49,400 lbs
25 Tons
Cable above break
Exhibit 11
5'
5'
Break
Test 2
Microscopic Test
B.W. 81,900 lbs
42 Tons
Cable on drum
Exhibit 13
2'
5'
Test 1
B.W 160,000 lbs.
80 Tons.
Microscopic Test
Sketch showing Breaking Strength, Protection Island Cable.
W. F. Robertson P.M.

Opinions as to the Results of the Tests.

First: The original cable, as represented by Exhibit No. 13, was a first-class cable in every particular, well made, and of excellent material. It was of "Lang's lay" build and apparently up to specifications. (*See* test No. 1.)

Note.—The Report of the Transvaal Commission, 1907, shows that 416 mines out of 427 there were using "Lang's lay" cables.

Second: The microscopic tests show conclusively that no crystallization had taken place in the steel of the cable. (*See* Dr. Stansfield's report and microphotographs.)

Third: The steel in the damaged part of the cable, after removing oxide from the exterior of the wires, was the same as in Exhibit No. 13, showing no chemical deterioration of steel had taken place. (*See* Dr. Stansfield's report.)

Fourth: Exhibit No. 7, water from the shaft. There was no free acid in the water that would dissolve the steel, but the water was of such composition as to rust the steel more rapidly than pure water would, and would also be apt to wash off any external lubrication of cable faster than would pure water. (*See* Dr. J. T. Donald's report.)

Fifth: Exhibit No. 9, the oil used in lubricating the cable. This was non-injurious to the steel. My opinion is that if applied superficially it would wash off quickly, and if applied cold to a cold rope it would not penetrate to the interior of the rope.

Note.—The Report of the Transvaal Commission, 1907, page XXI., shows that the accepted practice there is to apply the lubricant hot every week or two weeks, and then only certain oils penetrated the cable. Ben Thayer, chief mining engineer of all the Amalgamated Copper Company's properties (Butte), whom I went to see in New York, told me it was their practice to lubricate their cables by passing through a trough filled with oil kept very hot by a steam-jacket.

Sixth: Exhibit No. 13, rope from the drum. The external wires were slightly flattened or worn—it would be hard to say which—by contact with the drum. Such wear was insignificant. No projecting wire ends visible. Very little external oxidation had taken place; the wires were bright and covered with hardened oil; they had been lubricated. In the interior of this part of the cable the wires were all bright and free from rust. (*See* sample submitted, marked "C.") The interior hemp core was slightly greasy. (*See* sample submitted, marked "B.") The cable was in perfect condition.

Seventh: Exhibit No. 11, cable above break. Externally no wire ends were visible or projecting. The mechanical wear on the cable was not great; not sufficient to cause apprehension as to strength of the cable. The amount of rust visible on the surface was serious and showed when the cable was dry, but if the cable as it hung in the shaft was dirty, an inspection by passing the rope through the hand or against a stick would fail to reveal defect in the rope and was useless in this case.

In a shaft where the cable was subjected to heavy and constant work the wear on the external wires would probably be so great as to wear certain strands through, thus producing projecting ends, and these would be the first indications of deteriorations of such a cable. The hand test might then be of value.

In the Protection Island shaft the mechanical wear on the cable was slight, the failure being internal, and hence not discernible by the method of inspection in vogue. This piece of cable showed more surface oxidation toward its lower end.

Eighth: Exhibit 12. The same remarks apply as in seventh, with the exception that within 8 to 10 feet below the break a number of external wires were completely corroded through just where they fold under, which were visible on clean dry rope, but probably would not have been on dirty, wet rope; no loose ends stuck out.

Ninth: The failure of the cable was, in my opinion, entirely due to the oxidizing of the wires, chiefly internally, caused "by the apparent absolute lack of any internal* lubrication, leaving the wires exposed to the action of a more than normally corrosive water and a humid atmosphere."

The internal hemp core, which under a sufficiently effective lubrication system would serve as a reservoir of oil to keep the wires oiled and protected from corrosion, not being supplied with oil, became a reservoir of moisture and so hastened the corrosion of the wires. It is a well-

* Compare this with verdict of jury, in Mr. Wilkinson's report, page 351.

known fact that if rust gets started in a steel structure, such rust will continue despite any surface application of anything that may exclude the atmosphere. Hence, only a thorough soaking of the hemp core with oil before it is installed and a frequent renewal of the oil-supply would be necessary to ward off corrosion.

The fact that the tests showed the cable to be more corroded in certain parts than in others, and these not in any regular progression (*see* sketch herewith), may be accounted for by local conditions in the shaft of which I have no knowledge. The Transvaal Commission's Report recommends the cutting-off of a short piece of the cable every few months from the end next the cage and testing this for tensile strength. The location of weak spots in this cable would render this test futile, as it broke 179 feet above the cage.

A reference to the sketch showing tests will show that the section of cable about 4 or 5 feet from the fracture broke under a load of a little over 13 tons, and it stands to reason that the rope at the fracture had a lesser strength.

The weight of the empty cage is given by the company as 4,357 lb.; the rope, 179 feet, weighed about 540 lb.; sixteen men at average of, say, 170 lb., 2,720 lb.; making a known dead load of 7,617 lb., or approximately 4 tons. I understand the cable broke just about the time that portion of the cable passed over the sheave.

From a standard text-book, "Winding Engines and Winding Appliances," published in 1912, I have copied a table which I append hereto, which shows that when a cable of this description passes over a 10-foot sheave, it is by reason of the bending subjected to an additional load of 9,360 lb., or say, roughly, 5 tons. This, in addition to the dead load as above, would give a strain in the cable, if travelling slowly, of approximately 9 tons, which approaches so near to the breaking strain shown in test No. 5 that it is scarcely necessary to assume extraordinarily rough handling by the hoistman to account for the break.

As an indication that this sort of interior corrosion is not confined to the case in hand, I produce for your inspection a piece of 1¼-inch cable from a Sudbury mine which was tested at McGill in my presence. It broke at 58,600 lb., whereas the new cable had a breaking strength of about 128,000 lb. I think you will agree with me that this cable shows but little deterioration discernible externally, whereas in the broken end, also exhibited, the internal corrosion is excessive.

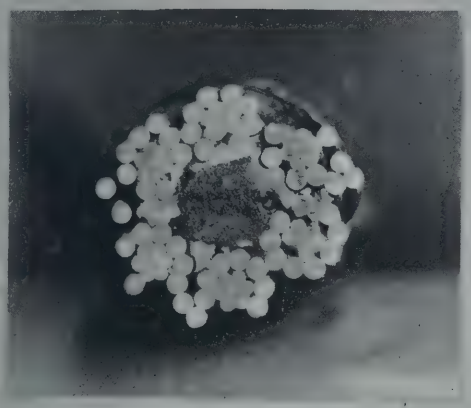
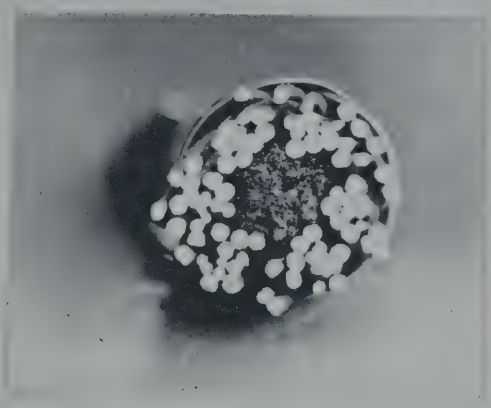
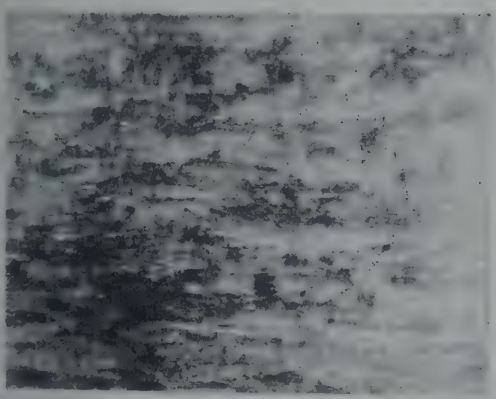
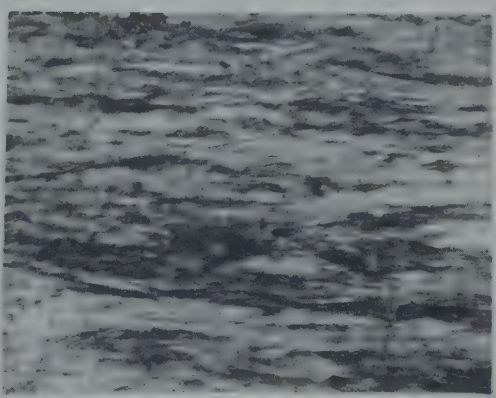
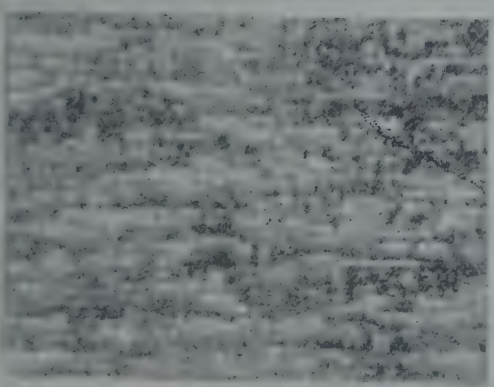
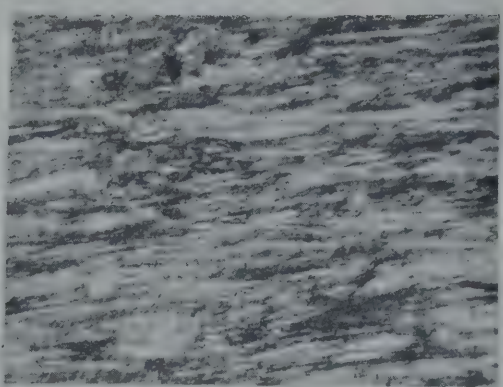
Springs.—Professor Mackay's report of these tests is submitted herewith, and shows that Exhibit No. 16, two unusued spiral springs, were of excellent quality, capable of a safe extension of about 30 per cent. of their length, and having a pulling power when so extended of about 1,250 lb.

These springs were all that could be desired. The various springs composing Exhibit No. 14 were so damaged by falling with the cage that but portions of them were available for testing. These portions tested, however, imperfect as the test was, showed a pulling power when extended of about 400 lb., which, if the clutches had been free to act, should have been enough to bring the clutches into action. These springs had been made of steel rod ½ inch in diameter, but were so corroded that there was in some places only metal of $^{5}/_{16}$ inch left. The absence or lack of any protective covering, such as oil, paint, or tar, is thus in evidence.

P.S.—Since writing the preceding report certain tests made as to the electrical resistance of various parts of the cable have been studied out, and these indicate that the sectional area of the steel wires remaining unoxidized in any particular part of the cable corresponds very closely with the breaking strength of that part. This corroborates the statement made that the steel unoxidized in the wires had still retained the strength it originally had, and that the cable throughout was of uniformly good quality of steel. These electrical tests are indicated in the accompanying sketch.

The fact that the proportionate electrical resistance of any part of a cable corresponds very closely to the amount of oxidization that has taken place in that part offers a very good indicator of the strength remaining in that part of the cable.

These facts have been fully set out in a paper prepared by the writer for the Canadian Mining Institute meeting, March, 1919, and further experiments are being made in the expectation of developing a method by which cables may be thus tested for strength by their electrical resistance in cases such as the present instance, where no external indication was given of the excessive oxidization that had taken place internally.

Specimen B (unused Cable)	Specimen A (Cable near break)
 Section of Cable nearly full size.	 Section of Cable nearly full size.
 Large Wire x80 dias. (unused cable)	 Large Wire x80 dias. (Cable near break)
 Small Wire x80 dias. (unused cable)	 Small Wire x80 dias. (Cable near break.)

Microscopic Sections of Wire Cable.

Copied from

Winding Engines and Winding Appliances,
by
McCulloch and Futers

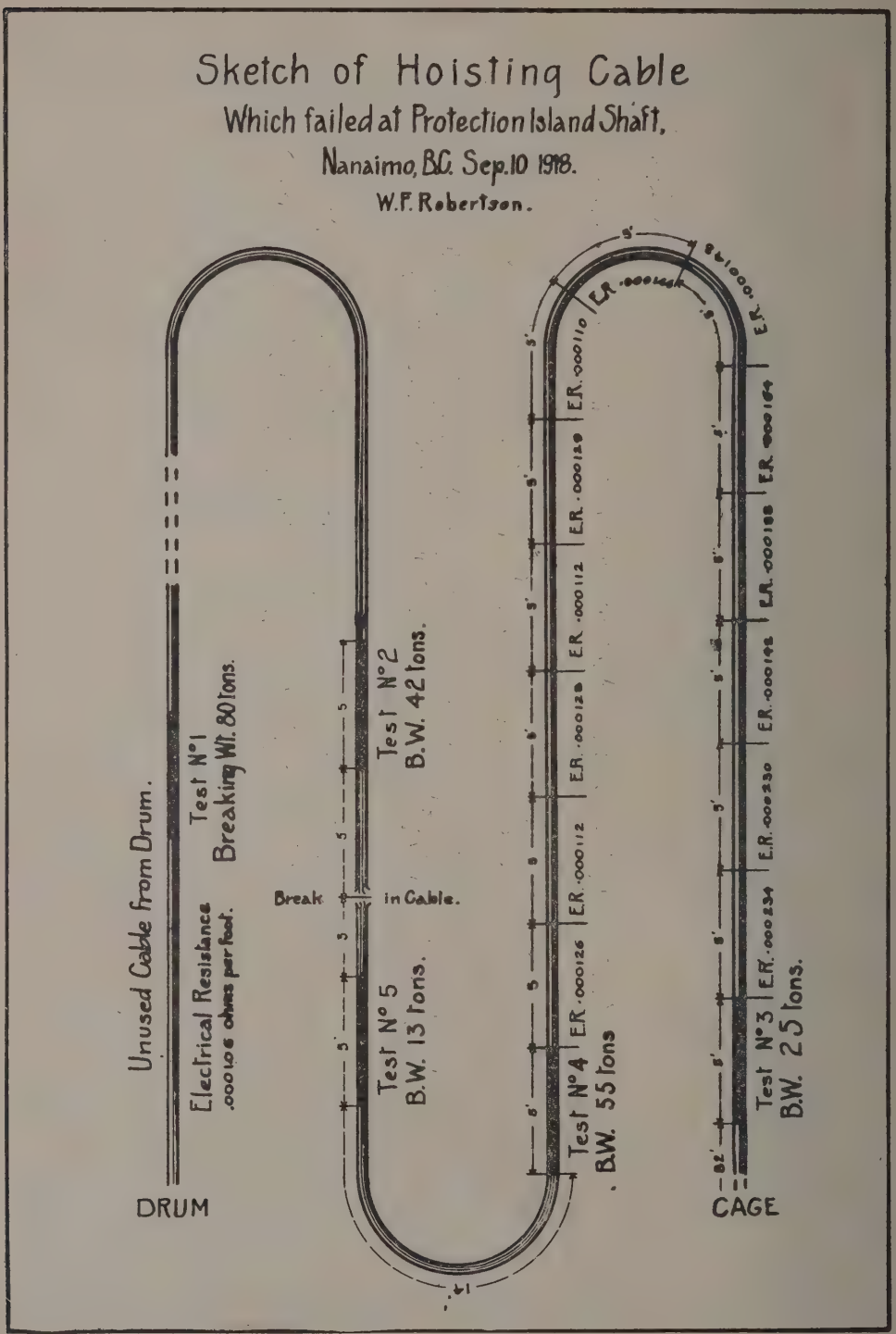
Published by Edward Arnold, London, 1912
on page 345

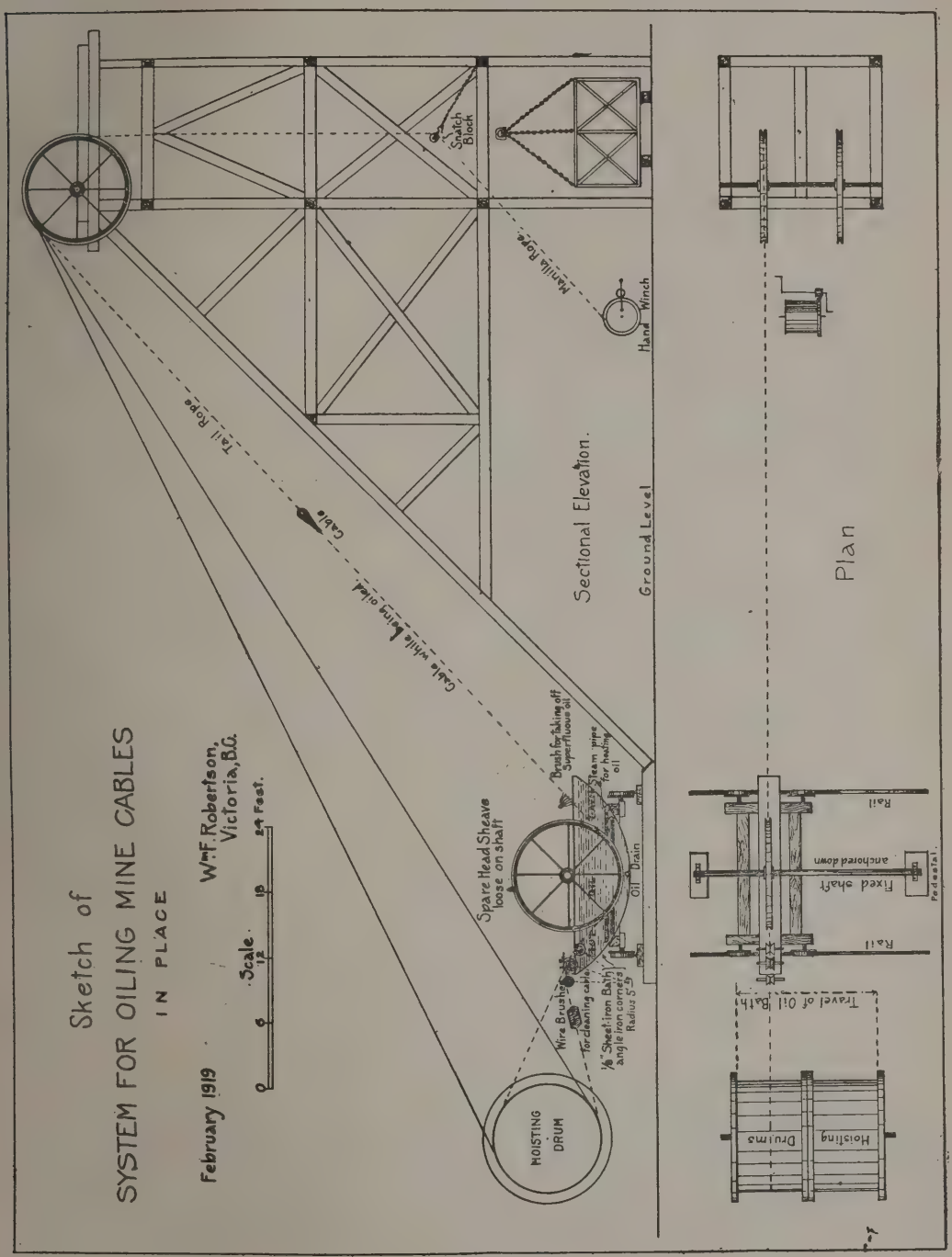
TABLE X

Assumed total additional load (p), in pounds, on ropes with 6 strands, 19 wires per strand and fibre core, if the stress on outermost fibres due to bending is 6,270,000 $\frac{d}{R}$ lbs. per square inch.

Approximate Circumference of rope in inches.	Approximate diameter in inches	Diameter of wire in inches	Sectional area each wire	Total sectional area	Diameter of drum or sheave, in feet, around which the rope is bent.							
					8′	9′	10′	11′	12′	13′	14′	15′
	3/4″	0.050	0.0014	0.224	1,465	1,300	1,170	1,065	976	904	836	780
	7/8″				2,280	2,025	1,885	1,660	1,520	1,405	1,305	1,217
	1″				3,520	3,128	2,820	2,560	2,350	2,165	2,015	1,875
	1 1/8″				4,900	4,370	3,925	3,578	3,275	2,800	2,625	2,460
	1 1/4″				6,700	5,945	5,350	4,865	4,460	4,120	3,820	3,570
	1 3/8″				9,100	8,100	7,300	6,630	6,090	5,600	5,215	4,860
	1 1/2″				11,700	10,400	9,360	8,500	7,800	7,200	6,680	6,230
	1 5/8″				14,750	13,100	11,780	10,750	9,850	9,070	8,410	7,860
	1 3/4″				18,300	16,250	14,650	13,300	12,190	11,200	10,460	9,750
	2″				27,500	24,500	22,000	20,500	18,350	17,000	15,720	14,680
	2 1/4″				39,500	35,100	31,600	28,700	26,300	24,300	22,500	21,000

W. F. Robertson
Prov. Mineralogist


Sketch of Hoisting Cable
Which failed at Protection Island Shaft,
Nanaimo, B.C. Sep. 10 1918.
W.F. Robertson.
Unused Cable from Drum.
Electrical Resistance .000106 ohms per foot.
Test N°1
Breaking Wt. 80 tons.
Test N°2
B.W. 42 tons.
Break in Cable.
Test N°5
B.W. 13 tons.
Test N°4
B.W. 55 tons
Test N°3
B.W. 25 tons.
DRUM
CAGE


Sketch of
SYSTEM FOR OILING MINE CABLES
IN PLACE
February 1919
Wm F. Robertson,
Victoria, B.C.
Scale
0 6 12 18 24 Feet.
Sectional Elevation.
Ground Level
Plan
Snatch Block
Manila Rope
Hand Winch
Tail Rope
Cable
Cable while being oiled
Spare Head Sheave loose on shaft
Brush for taking off Superfluous oil
Steam pipes for heating oil
Oil Drain
Wire Brush for cleaning cable
Sheet iron Bath angle iron corners Radius 5"
MOISTING DRUM
Rail
Fixed shaft
anchored down
Pedestal
Travel of oil Bath
Hoisting Drums

The evidence at the trial showed that a lubricant had been applied externally with some regularity, but the investigation demonstrated that such had not penetrated the cable. That penetration of the cable by the lubricant can only be accomplished when both are heated seems certain. The accompanying sketch is a suggestion as to how this can be cheaply accomplished at any colliery.

McGILL UNIVERSITY.

REPORT BY PROFESSOR H. M. MACKAY.

October 25th, 1918.

W. Fleet Robertson, Esq.,
Provincial Mineralogist, Victoria, B.C.

DEAR SIR,—I beg to report as follows upon the samples of wire cable and upon the helical springs from Nanaimo, B.C., submitted by you for test:—

I. WIRE CABLE.

Three lengths of cable were received in the laboratory:—

(1.) Described as taken from the winding-drum, marked "Exhibit No. 13."

(2.) Described as taken from the cable immediately above the break, marked "Exhibit No. 11."

(3.) Described as the length immediately below the break and attached to the cage, marked "Exhibit No. 12."

The cable was approximately 1½ inches in diameter and was made up of six strands. Each strand consisted of nine wires (average diameter 0.1255 inch), about a centre of six wires (average diameter 0.0852 inch, about a soft wire.

Test No. 1.—This sample was cut from the least-worn end of Exhibit No. 13 taken from the drum. The sample was in apparently good condition, although the oil was dried up and would not flow at ordinary temperatures. The sample was 36¾ inches long between the grips of the testing-machine. The load was applied in increments of 10,000 lb. and the extension over the clear length noted under each increment of load. These extensions were as follows:—

Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	36.76	....	....	90,000	37.14	0.38	0.05
10,000	36.80	0.04	0.04	100,000	37.20	0.44	0.06
20,000	36.84	0.08	0.04	110,000	37.27	0.51	0.07
30,000	36.88	0.12	0.04	120,000	37.35	0.59	0.08
40,000	36.92	0.16	0.04	130,000	37.45	0.69	0.10
50,000	36.96	0.20	0.04	140,000	37.61	0.85	0.16
60,000	37.00	0.24	0.04	150,000	37.87	1.11	0.26
70,000	37.04	0.28	0.04	160,000	Failed	....	....
80,000	37.09	0.33	0.05				

The ultimate strength was thus 160,000 lb., or 80 tons, and the behaviour of the sample was quite normal, the elongations especially being very uniform.

Thirty-six specimens of the larger wires and eighteen of the smaller cut from the section adjacent to sample No. 1 were tested individually. The larger wires (average diameter 0.1255 inch) gave an ultimate strength on the average of 208,000 lb. per square inch, or 2,540 lb. per wire. The smaller wires (average diameter 0.0852 inch) gave an average ultimate strength of 206,000 lb. per square inch, or 1,165 lb. per wire. The strength of the individual wires ran very uniformly. The fractures were well-developed "cups" or "semi-cups," indicating an excellent quality of material. The aggregate ultimate strength of all the wires composing the cable based on these tests was 179,100 lb. The ultimate strength of the cable was thus 89.35 per cent. of the aggregate ultimate strength of the component wires, which is quite satisfactory.

Test No. 2.—This sample was cut from Exhibit No. 11, and its position in the cable was about 4 feet away from and above the break. In brooming the ends for mounting the specimen a number of the small interior wires broke, being corroded away. All wires were badly rusted. In the section taken for test no broken wires showed on the surface. The outside wires were worn away to approximately half their original diameter. Loads were applied as in test No. 1 Elongations are given in the following table:—

Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	37.68	....	....	50,000	37.95	0.27	0.06
10,000	37.73	0.05	0.05	60,000	38.01	0.33	0.06
20,000	37.78	0.10	0.05	70,000	38.11	0.43	0.10
30,000	37.83	0.15	0.05	80,000	38.20	0.52	0.09
40,000	37.89	0.21	0.06	81,900	Failed	....	....

Four strands failed simultaneously, throwing out a cloud of dust. Above 77,000 lb. the cracking of wires was heard. The two remaining strands broke at 21,000 lb.

Test No. 3.—The specimen cut from Exhibit No. 12 was taken about 11 feet from the end attached to the cage, which was as near thereto as a representative specimen could be obtained. No broken wires showed on the outside, but a number of the small interior wires broke while brooming the ends for mounting. Practically all wires were much corroded, and the rope was quite dry and dusty, in much poorer condition than that in test No. 2. The results are as follows:—

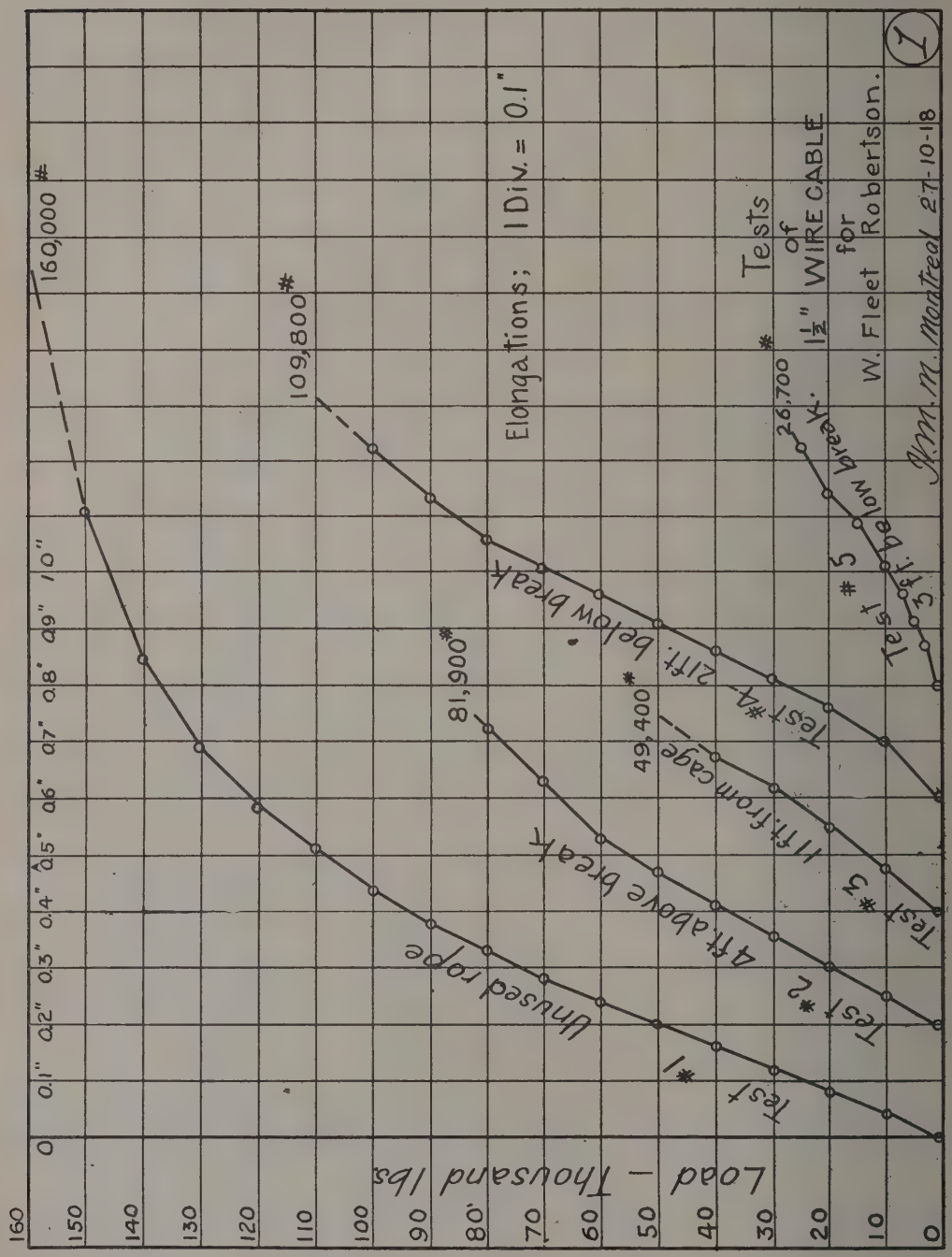
Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	38.93	....	....	30,000	39.15	0.22	0.07
10,000	39.01	0.08	0.08	40,000	39.20	0.27	0.08
20,000	39.08	0.15	0.07	49,400	Failed	....	....

Two strands failed simultaneously. The first audible cracking occurred at 39,800 lb. The wires at the point of failure were much reduced in section through corrosion.

Test No. 4.—This specimen was also cut from Exhibit No. 12, about 21 feet from the broken end. No broken wires were encountered in mounting the specimen. The results of the test follow:—

Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	38.34	....	....	70,000	38.75	0.41	0.05
10,000	38.44	0.10	0.10	80,000	38.80	0.46	0.05
20,000	38.50	0.16	0.06	90,000	38.87	0.53	0.07
30,000	38.55	0.21	0.05	100,000	38.96	0.62	0.09
40,000	38.60	0.26	0.05	106,000	1st crack	....	....
50,000	38.65	0.31	0.05	109,800	Failed	....	....
60,000	38.70	0.36	0.05				

Two strands broke at the last-mentioned load. Of the four remaining strands, one broke at a renewed load of 55,000 lb., a second at 55,400 lb., and the two remaining ones at a renewed load of 43,700 lb.


Load - Thousand lbs
Elongations; 1 Div. = 0.1"
Tests of 1½" WIRE CABLE for W. Fleet Robertson.
R.M.M. Montreal 27-10-18
Unused rope
Test #1
Test #2
4ft. above break
Test #3
11ft. from cage
Test #4
21ft. below break
Test #5
3 ft. below break
160,000 #
109,800 #
81,900 #
49,400 #
26,700 #

Test No. 5.—This specimen was also cut from Exhibit No. 12, but as near as possible to the broken end; that is, about 3 feet from the break. The specimen was very badly corroded, and while mounting the specimen it was found that more than one-third of the wires were entirely eaten away, some of them being visible on the outside. The following are the results:—

Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	30.74	....	....	15,000	30.97	0.23	0.06
3,000	30.80	0.06	0.06	20,000	31.01	0.27	0.04
5,000	30 83	0.09	0.03	25,000	31.08	0.34	0.07
7,000	30.87	0.13	0.04	26,700	Failed	....	....
10,000	30.91	0.17	0.04				

Three strands broke at 26,700 lb. and the remaining strands broke at a renewed load of 8,800 lb.

Fig. 1 shows graphically the results of the five tests plotted approximately to the same scale.

The specimens taken from the vicinity of or below the break thus gave ultimate strengths varying from 58.5 to 16.6 per cent. of the strength of the specimen taken from the drum. This great falling away in strength was, beyond any question, due to the badly corroded state of the wires, and particularly the interior wires composing the cable. In the opinion of the writer the failure of any lubricating agency which may have been applied to penetrate the interior of the cable was the principal factor in permitting such corrosion.

II. Helical Springs.

Ten springs were submitted, eight of which, marked "Exhibit No. 14," had been in service at the time of the accident. The two remaining ones, marked "Exhibit No. 16," were new and unused. All of the old springs, with one exception, were so distorted as to preclude the possibility of a fair test of the spring as a whole. Only one test, therefore, was made on the springs included in Exhibit No. 14. Loads were added in suitable increments applied in the same way as in service, and the elongations were noted as well as the permanent set, if any, when each load was released, until the elastic limit was well passed. This spring, originally ½ inch in diameter, as appeared from measurements at the end, was so corroded that the diameter throughout its length was in general reduced to ⅜ inch, and in some places where the remaining section was oval the shorter diameter was about $^{5}/_{16}$ inch. Six of the seven remaining old springs were in approximately the same condition as regards corrosion. The seventh, however, was affected but little and retained approximately its original diameter. The results of the test follow:—

Outside diameter of coil ..... 2.94 inches.
Diameter of wire ..... ⅜ inch (approx.)
Number of coils between gauge-points .....= 52

Loads.	Length between Gauge-points	Elongation.	Permanent Set.	Loads.	Length between Gauge-points	Elongation.	Permanent Set.
Lb.	Inches.	Inches.	Inches.	Lb.	Inches.	Inches.	Inches.
.....	26.70	....	....	400	32.94	7.24	0.11
200	28.28	2.58	0.03	450	33.95	8.25	0.20
300	30.52	4.82	0.07	500	35.95	10.25	0.60
350	31.95	6.25	0.09	550	37.44	11.74	1.33

It will be noted that the elasticity of the spring was imperfect, as indicated by the permanent set following the application of each load.

The two new springs, Exhibit No. 16, were tested in a similar manner. In the case of the first the loads were applied by a testing-machine, while in the case of the second weights were hung on the suspended spring. The results of the two methods were in practical agreement. The elastic limit in the one case was reached at a load of 1,200 lb. and in the other at a load of 1,300 lb. There were no permanent sets until these loads were applied, the elasticity at lower loads being perfect. The maximum shearing stresses at the elastic limit were 61,100 lb. per square inch and 66,200 lb. per square inch respectively, which is quite satisfactory. It was

Tests of
HELICAL SPRINGS
for
W. Fleet Robertson.
Elongations in 25.7 ins.
4460 in.lbs
30% Elongation.
Elongations in 25.7 ins. 1850 in.lbs
30% Elong. = 1850 in.lbs
New Spring, Stored 30%
Work
Old Springs. Worn stored 30% Elong.
% Elongn.
Elongations
Loads
lbs.
Rm. M. Montreal 29-10-18
2

noticed that the first indications of overstrain appeared in the coils adjacent to the castings to which the springs were attached, and for this reason measurements of elongation on different springs are not strictly comparable unless made between gauge-points similarly situated in each case. In testing the second of the new springs, measurements were taken from points corresponding exactly to those of the old spring. The following results for the unused springs are, therefore, comparable with the data obtained from the old one given above.

Outside diameter of coil ..... 3.02 inches.
Diameter of rod ..... ½ inch.

Loads.	Distance between Gauge-points	Elongation.	Permanent Set.	Loads.	Distance between Gauge-points	Elongation.	Permanent Set.
Lb.	Inches.	Inches.	Inches.	Lb.	Inches.	Inches.	Inches.
....	25.70	....	....	800	31.34	5.64	....
200	26.31	0.61	....	1,000	33.01	7.31	....
400	27.99	2.29	....	1,200	34.83	9.13	....
600	29.65	3.96	....	1,300	36.32	10.62	0.04

The results of these two tests are plotted in Fig. 2. It will be seen that for a given elongation the pull exerted by the old spring is rather less than 40 per cent. of that exerted by the new, while the energy stored is in about the same ratio. Thus, while the old springs may possibly have been sufficient for the work required of them, the tests indicate that they have lost, through corrosion or otherwise, about 60 per cent. of their efficiency. Theoretical conclusions based on the difference of section are in close agreement with the results of the tests.

It may be noted that an elongation of 30 per cent. causes stresses in the springs approaching the elastic limit.

Yours faithfully,
H. M. MACKAY,
Professor of Civil Engineering.

MICROSCOPIC EXAMINATION OF SOME WIRES FROM A STEEL CABLE.

By Dr. Alfred Stansfield and A. Gordon Spencer.

The following is a report of microscopic examination of wires from parts of a steel-wire cable received from Wm. Fleet Robertson, Esq., Provincial Mineralogist of British Columbia:—

These samples were selected from parts of the cable which had been brought to McGill University by Mr. Robertson and were given to us by him personally.

Mr. Robertson supplied us with the following information with regard to the cable:—

Length of cable: 910 feet.
Diameter: 1½ inches.
Construction: Six strands of sixteen wires each, hemp centre, "Lang's lay."
Quality: Best patent improved crucible cast steel.
Manufacturers: T. & W. Smith, Limited, Newcastle-on-Tyne.
Ordered from: Evans, Coleman & Evans, Limited, agents.
Date ordered: October 2nd, 1914. Order No. 8820.
Received: February, 1915.
Placed in service: Immediately after being received.

The samples given to us by Mr. Robertson were as follows: Specimen A, from Exhibit No. 11, a piece 10 inches long taken from the cable at a point eight feet above the break; specimen B, from Exhibit No. 13, a piece 8 inches long taken from that part of the cable which had remained on the winding-drum.

Specimen A was badly rusted. No free oil or grease was visible, but the interstices were filled with a dry brownish material as if composed of a mixture of rust and dirt. The outer large wires were flattened from wear, and all the wires in every strand were very much corroded and reduced in diameter.

Specimen B was well impregnated with grease and the wires appeared to be quite round, smooth, rust-free, and generally in excellent condition. Both specimens had been cut from the cables with an acetylene torch, but all samples for microscopic examination were taken from points sufficiently removed from the heated ends of specimens. Two large and two small wires from each of two opposite strands in each specimen were taken for this purpose, or sixteen wires in all.

Chemical analyses were made of one large and one small wire from one strand of specimen A and from one large and one small wire from specimen B. The results were as follows:—

	Carbon, per Cent.	Manganese, per Cent.
Large wire, specimen A, used cable just above break	0.59	0.70
Small wire, specimen A, used cable just above break	0.58	0.62
Large wire, specimen B, unused cable from drum	0.58	0.70
Small wire, specimen B, unused cable from drum	0.59	0.62

This chemical examination was made as a guide for the interpretation of the microscopic structure of the wire. The tests were not intended to show whether the wire was or was not of suitable chemical composition, but, as far as they go, the results of these analyses show the wires to be of suitable and uniform chemical composition.

The wires selected for microscopic examination were suitably mounted, and each was ground down so as to expose a longitudinal section. The wires were examined microscopically, both in the polished condition and after the usual etching with nitric acid. The microscopic examination was made at magnifications of from 50 to 500 diameters. The structure observed in all cases was the normal structure of cold-drawn steel wire, and we have been unable to detect any evidence of crystallization or of any internal deterioration of the wire such as might have been caused by strain while in service.

We append photographs showing the structure of four of these wires—one large and one small wire from specimen A and one large and one small wire from specimen B; all of these being magnified to an equal extent. We also give photographs, nearly full size, of complete cross-sections of specimen A and specimen B. These photographs give an idea of the extent to which the wires in specimen A had been corroded.

Alfred Stansfield.
A. Gordon Spencer.

McGill University, Montreal, October 28th, 1918.

CHEMICAL TESTS OF WATER AND OIL.

Report by J. T. Donald & Co., Consulting Chemists and Analysts, Montreal.

318 Lagauchetiere Street West,
Montreal, October 16th, 1918.

W. F. Robertson, Esq.,
Provincial Mineralogist, Victoria, B.C.

Dear Sir,—We have examined the sample of water marked "Exhibit No. 7, H.H." received from you on the 8th inst. We have obtained the following figures in our examination:—

	Grains per Imp. Gal.
Total solids	1,569.89
Chlorine	773.00
Sulphuric anhydride	8.40
Lime	54.87
Magnesia	79.61
Carbonic acid	Traces

These figures indicate that this water is a highly saline one, and that the saline matter consists almost fully of the chlorides of lime, magnesia, and soda. These saline matters render this water very corrosive, and if it were allowed to drip repeatedly on the same point in a cable the same would be rapidly corroded. You can understand what we mean when you recall the action of salt water on metal surfaces.

If the supply of water had been larger we could have gone somewhat more fully into detail, but such detail would not alter the conclusion above stated—namely, that this is a highly saline water, and as such markedly corrosive in its action on iron and steel.

Yours faithfully,
J. T. Donald & Co.

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318 Lagauchetiere Street West,
Montreal, October 24th, 1918.

W. F. Robertson, Esq.,
Provincial Mineralogist, Room 1818, Windsor Hotel, Montreal.

Dear Sir,—We reply to your inquiries concerning the mode of combination of the various radicals in the sample of water to which we referred in our letter of the 16th inst. It is probable the radicals are grouped so as to form the following:—

	Grains per Imp. Gal.
Calcium sulphate	14.15
Calcium chloride	103.00
Magnesium chloride	190.00
Alkali chlorides	1,262.00

As regards your second question, we record that if this water were coming in contact with a cable that is coated with lubricating-oil, the saline matters are not likely to saponify the oil or that part of it that may be saponifiable. It is probable the oil is largely, if not entirely, mineral oil, and therefore unsaponifiable. If, however, conditions are such that this water would drop continuously on the same point of the cable, the frequent dripping would tend to brush aside the oil and corrosion might follow. If, however, this water would drip for any length of time on the same part of the cable unlubricated, there would be rapid corrosion.

If this does not answer your questions or any points are not clear, we trust that you will communicate with us.

Yours faithfully,
J. T. Donald & Co.

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318 LAGAUCHETIERE STREET WEST,
MONTREAL, October 16th, 1918.

W. F. Robertson, Esq.,
Provincial Mineralogist, Victoria, B.C.

DEAR SIR,—We have examined the sample of lubricating-oil marked "Exhibit No. 9, H.H.," and received from you on the 8th inst.

We find nothing in this oil that would cause corrosion of iron or steel cables. It is a heavy mineral oil with a small percentage of saponifiable oil and containing only a very slight amount of free fatty acid. It is a good oil for this purpose—namely, heavy lubrication.

Yours faithfully,
J. T. DONALD & CO.

EXPERIMENTAL TESTS OF SAFETY-CATCHES.

REPORT BY GEORGE WILKINSON, CHIEF INSPECTOR.

I beg to submit the following report on tests of the efficiency of safety-catches made at Reserve mine, Nanaimo, B.C., on October 21st and November 11th, 1918:—

PREPARATIONS FOR TESTS.

Preparations were made at the Reserve mine for carrying out a series of tests for demonstrating the efficiency of the safety-catches in use at the Canadian Western Fuel Company's mines by subjecting them to tests which are as near as possible the conditions that would be met in the occurrence of accidents during working conditions, namely: (1) Rope breaking with ascending cage; (2) rope breaking with cage stationary; (3) rope breaking with descending cage. For this purpose a full-dimensioned shaft was made between the bents of the trestle-work at the Reserve mine, guides and buntons being placed just the same as actual conditions in a shaft. A full-sized cage was used under the same conditions as it would be used in a shaft. A small hoist of the friction-clutch type driven by compressed air was installed for the purpose of hoisting up the cage. An automatic slip-link was used between the connecting-link on the cage and the cone of the rope. This slip-link was so made that its position could be reversed and the rope cut off on the ascending or descending cage. The bottom of the shaft was filled up with sacks of straw to absorb the shock in case of the cage falling to the bottom of the shaft.

METHODS OF TESTING.

Test No. 1.—The cage was stationary and rope cut off by the automatic trip and cage allowed to fall. The cage dropped 1¼ inches and catches came into operation, stopping the cage in the above-mentioned distance.

Test No. 2.—The cage was hoisted to the top of the shaft, and a hemp rope was attached to the arm of the automatic slip-link, and the other end attached to a bunton at the top of the shaft and sufficient slack rope left to give the cage a free drop of 7 feet; the friction and brake were then thrown off the engine, allowing the cage to suddenly drop. When the cage reached the point the slack rope allowed the rope was automatically cut off, allowing the cage to descend rapidly, similar to what would happen with a rope breaking close to a descending cage. The catches failed to operate under this test and the cage fell to the bottom of the shaft. There were no signs of the catches gripping until the fall of the cage was partially arrested by the sacks of straw; then the catches gripped for about a foot in length along the guides, or just about the amount the sacks were compressed by the weight of the cage.

It would appear as though just as the resistance of the sacks of straw came into operation against the floor of the cage, then the catches started to operate, which would indicate there was not a slackening of the chains until the speed of the cage was arrested.

Test No. 3.—Another test of disconnecting the rope when cage was descending, the operations were practically the same as test No. 2, the only difference being the rope was disconnected sooner, giving the cage a shorter drop. In this test the safety-catches failed to operate and the cage again fell to the bottom of the shaft.

Test No. 4.—Cage stationary as in test No. 1; catches came in operation but failed to stop the cage; it kept sliding gently to the bottom of the shaft, which I think was due to the fact of the teeth of the cams being full of wood gouged out of the guides in previous tests.

Test No. 5.—The cage was ascending as quickly as the hoist could run. The slip-link was reversed in position and the hemp rope attached to a bunton in the shaft, so that when the cage reached a certain position in the shaft the hoisting-rope would be automatically cut off. This point was selected at about two-thirds the distance up the shaft. When the cage was hoisted to this point the hoisting-rope was automatically cut off and the cage allowed to fall. The safety-catches immediately came into operation and arrested the fall of the cage in a distance of 1 inch.

Test No. 6.—The cage was hoisted to the top of the shaft; the slip-link was attached with sufficient slack rope to allow a fall of 9 feet. The cage was then allowed to fall as fast as the loose drum could turn with the weight of the cage, the rope disconnected, and the cage allowed to fall. The safety catches failed to operate and the cage fell to the bottom of the shaft.

In all the tests with the cage descending the catches failed to arrest the fall of the cage to the bottom of the shaft. In the test with the cage ascending and the first test with the cage stationary, the catches operated successfully and stopped the cage in a very short distance.

In test No. 4, the second test with the cage stationary, the cage slipped to the bottom of the shaft, but I think the failure to stop the cage was due to the fact (as mentioned previously) of the teeth of the cams being full of wood gouged out of the guides in previous tests.

The failure of the catches on the descending cage led to considerable discussion as to the cause, and it was suggested that with sharper teeth and stronger springs the difficulty might be overcome. So with this end in view Thomas Price, master mechanic for the Canadian Western Fuel Company, designed a new cam with one tooth. In preliminary trials this cam gripped, but the weight of the cage turned the cam completely around. To prevent this a piece of angle-iron was riveted to the side of the cage to prevent the cams from turning over, and all was in readiness for a second series of tests.

Second Series of Tests.

The second series of tests was made on November 11th at the Reserve mine. The method of tests were as follows:—

Test No. 1.—The cage was placed in a stationary position and the hoisting-rope automatically cut off. The catches immediately came in operation and arrested the fall of the cage in a distance of 1 inch.

Test No. 2.—The slip-hook was attached and approximately 10 feet of slack rope given and the end fastened to a bunton in the shaft. The cage was then hoisted as quickly as possible. When the end of the slack rope was reached the hoisting-rope was automatically cut off. The catches immediately came into operation and arrested fall of the cage in 1 inch.

Test No. 3.—The cage was hoisted to the top of the shaft and the slip-hook reversed and about 7 feet of slack rope allowed, so that there would be a drop of the cage that distance before the hoisting-rope was detached. The cage was then dropped quickly, the hoisting-rope cut off, and the cage allowed to fall. The catches came into operation and arrested the fall of the cage in 5 inches. The stopping of the cage was very violent, the tooth of the cam biting into the guides nearly 2 inches.

Test No. 4.—This test was similar to test No. 3, but the cage was allowed to run a greater distance before the hoisting-rope was cut off. The catches again came into operation and stopped the cage in a short distance, but the stop was very violent and the teeth of the cams bit very deeply into the guides.

In all the second series of tests the safety-catches operated successfully and were effective in arresting the fall of the cage. The stopping of the cage in Nos. 3 and 4 tests with the descending cage was very violent, even at the slow speed the cage was travelling, and it would be difficult to imagine what would be the result if these catches came into operation with the cage travelling at a high speed, of, say, 30 or 40 feet per second.

Third Series of Tests.

A third series of tests was made on November 22nd, which did not work out very good.

Test No. 1.—The cage was placed in a stationary position and the rope automatically cut off. The catches operated successfully and stopped the fall of the cage in a distance of 1¼ inches.

Test No. 2.—The cage was hoisted up the shaft and the rope was automatically cut off while the cage was in motion. The catches operated successfully and stopped the fall of the cage in 2 inches.

Test No. 3.—The cage was allowed to descend quickly with the intention of having the rope cut off automatically when it reached a given point, but the catches came into operation and stopped the cage while it was descending before the rope was cut off.

Test No. 4.—The cage was allowed to descend again with the intention of cutting off the rope when in motion, but too long a length of rope (slack) was allowed and the cage struck the bottom of the shaft before the slip-hook came into operation and detached the rope. During the test the hoist was unfortunately broken and the cage could be hoisted only by means of rope around the counter-shaft.

Test No. 5.—The cage was hoisted to a certain position in the shaft and the rope automatically cut off, allowing the cage to fall. The safety-catches successfully operated and stopped the fall of the cage in 2 inches.

After watching the various tests the writer's opinion is that cam catches operated by springs similar to the ones tried cannot be relied on to effectually stop the fall of the cage under all circumstances. There seems to be no doubt about their successful operation in a case of overwind, or even in case of a rope breaking on the ascending cage, but in the case of a descending cage it is doubtful if they would successfully operate in any case.

It would seem that the spring tension required to overcome the drag of a length of rope that may be left between the cage and the break and also the drag of the chains is an unknown quantity. In the tests made it seemed that if too much tension pull is given there is danger of the catches coming in operation with a quickly descending cage without the rope breaking, which would be a very dangerous factor in shafts where quick hoisting is done. To give the springs the right tension pull and keep them in the same condition at all times for a successful operation on a descending cage would be practically impossible.

Some interesting facts were developed by a series of experiments carried out by a Commission in the Transvaal, and the following tests are quoted and may be of interest:—

SUCCCESSFUL SAFETY-CATCHES.

Report of the Transvaal Commission on Safety-catches for Mine-cages—Results of a Series of Experiments.

The Commission appointed by the Transvaal Government to investigate the use of "winding" or hoisting-ropes, safety-catches, and appliances in mine-shafts has recently made public its report. This Commission consisted of twenty-three engineers and experienced mine managers, among them a number of well-known Americans.

Methods of Testing.

Cages equipped with the safety appliances to be tested were usually submitted to the following experiments in the order given:—

(1.) *Cage with no Velocity.*—(*a*) Empty cage lifted a little above the chain and then let go by means of a slip hook; (*b*) cage loaded with 3,000 lb. tested as in (*a*).

(2.) *Cage falling with a 3-foot Head Velocity.*—(*a*) Empty cage; (*b*) cage loaded with 3,000 lb. In this test safety-catches were by various devices kept from acting until the cage had fallen 3 feet freely.

(3.) *Test with Cage descending, Rope attached.*—In this test the usual hoisting-rope was attached to the drum of the engine by means of a light hemp rope. The engine was then run back sharply, allowing the cage to rapidly descend for various desired distances, when the hoist-rope would be attached by the breaking of the hemp rope and allow the cage to fall freely with the hoist-rope attached.

Tests of the Ordinary Cam Safety-catches.—The first experiments conducted by the Commission were on the cage equipped with the ordinary toothed cam device commonly in use on the Rand. When the cage was overwound and when dropped both empty and loaded from rest, the cams acted immediately and were entirely satisfactory. When the empty cage was given a 3-foot free fall, however, although the cams acted promptly and stopped the cage in a distance of 6½ inches, they cut into the guides 1 inch on each side, damaging them considerably. In addition, the shock of the sudden stop was great.

The test of the loaded cage given a 3-foot free fall was a failure, as the cams cut the guides enough to allow their turning completely around, and thus let the cage fall to the stops, consisting of 10-inch timbers covered with bags of ashes. Heels were then added to the cams to prevent their turning around and all tests except the last proved satisfactory.

In this last test the loaded cage was sharply lowered a distance of 106 feet and had a speed of 1,100 feet per minute at the time of rope disconnection. As a result the cams gripped the guides violently and broke them, the cage tilted across the shaft and fell 40 feet to a point where it became firmly wedged in the shaft timbers.

Note.—These tests seem to indicate the reliability of cams to act promptly, stop a cage suddenly (if at all), and thus damage the guides considerably. In the case of no or small velocity at the time of action the suddenness of stop may result in only a harmless shock to cage passenger. With high velocity, however, not only is the shock dangerous to passengers, but may break the guides and allow the cage to fall.

In the same manner that the British Board of Trade permits the use of certain safety-valves for marine boilers, and just as the British Home Office has published a list of "Permitted Explosives" for use in coal-mines, so, it is considered, should the Mines Department prescribe which safety-catches are to be classed as suitable for the various kinds of shaft.

The Commission, while not wholly satisfied that any of the safety-catches tried entirely meets the requirements of such an apppliance, considers that, of the designs submitted, the following give the most satisfactory results: for vertical shafts with wooden guides, the Undeutsch; for vertical shafts with wooden guides, the Schweder; for vertical shafts with steel guides, the Schweder; for inclined shafts with steel rails, none at present, but advise early trials of suitable designs.

The Commission recommends that no safety-catch should be placed on a "permitted" list until its reliability has been thoroughly established by tests similar to those carried out at the Marcus shaft, such tests to be conducted at Government expense and under the direction of the Government mining engineer, notice of which tests should be advertised previously in the daily press. It is also considered that the inventor should supply and deliver at the testing-station, free of cost to the Government, the full-sized working appliances ready to be fitted to a cage of standard dimensions.

EXPERIMENTAL TESTS OF SAFETY-CATCHES.

REPORT BY ANDREW BRYDEN.

Acting under instructions received from the Minister of Mines on September 11th, 1918, to proceed to Nanaimo with the object of examining and making a report on the rope and safety device the failure of which caused sixteen fatalities in Protection shaft on September 10th, 1918:

On arrival in Nanaimo I went to Protection shaft, the scene of the accident, in company with the Minister of Mines, the Chief and District Inspectors, also the jury empanelled to ascertain the cause of the death of sixteen of their fellow-men. On examining the rope at the point of rupture, the outside wires had no appearance of weakness, little or no surface wear, and their tensile strength but very little impaired, but the inside wires of each strand were in a really bad condition from internal corrosion, so much so that they could easily be picked out with the fingers; the rope, in fact, was in a very dangerous condition. But its real condition could not possibly be ascertained by the usual superficial method of examination—that is, by running the rope through the hands—as there were no broken wires or surface wearing that would indicate that the rope was in any way out of its normal condition.

The usual recapping of the rope at frequent intervals would not in this case have avoided accident, although very much to be commended. The tests made under the supervision of Mr. Robertson, the Provincial Mineralogist, have demonstrated the fact that the rope was in much better condition near the cage than at points distant from the cage. The use of the thin splicing-spike would have been the only method of ascertaining the inside condition of the rope. A flat spike can be inserted and the heart of a rope exposed without the slightest injury to a rope that has retained its flexibility and tensile strength; but to the rope that is somewhat impaired from corrosion it would probably be injurious, yet, in my opinion, it is the only way of being sure that the rope is fit for the onerous duty imposed on it.

Mr. Robertson's report no doubt has eliminated from the minds of a great many people—let me say myself, among others—that the hoisting engineer had probably contributed largely towards the accident by the rough handling of the engine, as the evidence given to the jury to a certain extent left that impression. The shortness of the break in the rope in comparison to that of a strain had almost confirmed me in believing so too, but Mr. Robertson's report sets that idea at rest, as he has demonstrated the fact that the rope was not capable of standing the abuse attributed to his work.

To be fair and impartial, I do not mind placing myself on record in saying that had I made the examination of the surface appearance of the rope—I mean the usual superficial method—I would have stepped on the cage in all confidence that the rope was safe. After examining the rope in company with the Chief and District Inspectors, we examined the guides in the shaft to ascertain whether the safety-catches had made any attempt to perform the work they were designed for and expected to do, but at no place in the whole distance through which the cage had passed after the parting of the rope was there shown any indication that the catches had come into the slightest operation. This determined the Minister of Mines to have the device subjected to a series of tests with the object of ascertaining their value as a factor of safety where lives were entrusted to their efficiency.

On October 19th I was informed by the Chief Inspector that he was prepared to begin on Monday, the 21st, the tests of the safety-catches as ordered by the Minister of Mines. On that date we went to the Reserve mine of the Western Fuel Company, where a perfect lift was rigged up with cage-catches and winch such as would be used in the ordinary working of a mine. The tests we made were no doubt under ideal conditions favouring the device, altogether different from those obtained in a shaft under working conditions; the guides were new, the corrugation of the cams clean, the springs newly overhauled, and, I may say, everything in favour of the device.

The tests made with the cage ascending were fairly successful, but with the descending cage the catches failed entirely to operate; and one test with the cage at rest, when the detaching-hook was cast loose, the cage staggered momentarily from guide to guide and then dropped to the bottom.

Needless to say that in my opinion the term "safety" is a perfect travesty to the name.

I am so thoroughly convinced that after the tests were made, with everything favouring the device, and found wanting, that under ordinary conditions where the cams are blocked with grease and dirt, the guides wet and slimy, and in many cases worn below their original size through many years of work, this particular device is rather a menace than a source of safety.

In conclusion, let me say that we were afforded every assistance and co-operation by Mr. Hunt and other officials of the Western Fuel Company to honestly establish the standing of safety-catches as a factor of safety.

EXAMINATIONS FOR COAL-MINE OFFICIALS.

The "Coal-mines Regulation Act," as now consolidated and amended, provides that all officers of a coal-mining company having any direct charge of work underground shall hold Government Certificates of Competency, which are to be obtained only after passing an examination before a duly qualified Board, appointed for the purpose of holding such examinations, and known as the Managers' Board.

The certificates granted on the recommendation of such Board and the requirements shall be as follows:—

"(*a.*) If a candidate for a manager, that he is a British subject and has had at least five years' experience in and about the practical working of a coal-mine, and is at least twenty-five years of age; or, if he has taken a degree in scientific and mining training, including a course in coal-mining at a university or mining school approved by the Minister of Mines, that he has had at least four years' experience in and about the practical working of a coal-mine:

"(*b.*) If a candidate for overman, that he has had at least five years' experience in and about the practical working of a coal-mine, and is at least twenty-three years of age:

"(*c.*) If a candidate for shiftboss, fireboss, or shotlighter, that he has had at least three years' experience in and about the practical working of a coal-mine, is the the holder of a certificate of competency as a coal-miner, and is at least twenty years of age:

"(*d.*) A candidate for a certificate of competency as manager, overman, shiftboss, fireboss, or shotlighter shall produce a certificate from a duly qualified medical practitioner or St. John or other recognized ambulance society, showing that he has taken a course in ambulance-work fitting him, the said candidate, to give first aid to men injured in coal-mining operations.

"For the purposes of this section the experience demanded by such section shall be of such character as the Board shall consider of practical value in qualifying the candidate for the position to which such class of certificate applies.

"Experience had in a mine outside of the Province may be accepted should the Board consider such of equal value."

Any certificate is considered as including that of any lower class.

EXAMINATION FOR MINERS.

In addition to the examinations and certificates already specified as coming under the Managers' Board, the Act further provides that every coal-miner shall be the holder of a certificate of competency of such. By "miner" is meant "a person employed underground in any coal-mine to cut, shear, break, or loosen coal from the solid, whether by hand or machinery."

Examinations for a miner's certificate are held each month at each colliery by a Board of Examiners, known as the Miners' Board, and consisting of an examiner appointed by the owners, an examiner elected by the miners of that colliery, and an examiner appointed by the Government.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

FIRST-, SECOND-, AND THIRD-CLASS CERTIFICATES.

Report of Tully Boyce, Secretary of Board.

I beg to submit the annual report covering the transactions of the above Board for the year ending December 31st, 1918.

The Board consists of Thos. R. Stockett, of Vancouver, Chairman; Andrew Thomson, of Nanaimo, Vice-Chairman; Tully Boyce, of Nanaimo, Secretary; Geo. Wilkinson, of Victoria, Chief Inspector of Mines; Andrew Bryden, of Vancouver; and Bernard Caufield, of Coal Creek.

An examination for First-, Second-, and Third-class Certificates was held on the 14th, 15th, and 16th days of May at Nanaimo, Cumberland, Merritt, and Fernie, at which there were 47 candidates, as follows: For first-class there were 16 candidates, 4 of whom passed and 12 failed; for second-class there were 16 candidates, 6 of whom passed and 10 failed; for third-class there were 15 candidates, 12 of whom passed and three failed.

Another examination was held for First-, Second-, and Third-class Certificates on the 17th, 18th and 19th days of December at Nanaimo, Cumberland, Fernie, and Princeton, at which there were 29 candidates, as follows: For first-class there were 8 candidates, 5 of whom passed and 3 failed; for second-class there were 8 candidates, all of whom passed; for third-class there were 13 candidates, all of whom passed.

Certificates of competency have been applied for and issued to all the successful candidates, and to a successful candidate for first-class who passed at the examination held November, 1917, but failed to apply for his certificate in time to have his name recorded in the report for that year. The names of the successful candidates are herewith enclosed.

LIST OF CANDIDATES TO WHOM CERTIFICATES WERE ISSUED AT THE EXAMINATIONS HELD ON MAY 14TH, 15TH, AND 16TH, 1918, AT NANAIMO, CUMBERLAND, MERRITT, AND FERNIE; AND ON DECEMBER 17TH, 18TH, AND 19TH, 1918, AT NANAIMO, CUMBERLAND, FERNIE, AND PRINCETON.

First-class Certificates.

Name.	Date.	No.
Higgins, Alexander	Dec. 19th, 1918	
Ramsay, Peter Millar	May 16th, "	
Smith, Thomas Edwin	Dec. 19th, "	
Taylor, James	May 16th, "	
Walker, William	May 16th, "	
Wesmedge, William	Dec. 19th, "	
Whittaker, John	Dec. 19th, "	
Williams, John Samuel	Dec. 19th, "	
Wilson, William	May 16th, "	

Second-class Certificates.

Name.	Date.	No.
Barlow, Benjamin Robert	Dec. 19th, 1918	B 229
Brown, George	Dec. 19th, "	B 225
Brown, William Gold	Dec. 19th, "	B 228
Coupland, George	May 16th, "	B 217
Gourlay, Robert	Dec. 19th, "	B 227
Greenwell, Archibald	May 16th, "	B 220
Hastings, Andrew Peacock	Dec. 19th, "	B 223
Holliday, William	Dec. 19th, "	B 230
Jones, Samuel	May 16th, "	B 221
Morgan, William	Dec. 19th, "	B 224
Rowbottom, Thomas	May 16th, "	B 222
Rutherford, Jasper	May 16th, "	B 219
Scarpino, Francis	Dec. 19th, "	B 226
Sutherland, John	May 16th, "	B 218

Third-class Certificates.

Name.	Date.	No.
Ainsworth, Edward	May 16th, 1918....	C 674
Blinkhorn, Thomas	Dec. 19th, 1918....	C 681
Bysouth, Thomas	May 16th, 1918....	C 673
Caufield, Edward	May 16th, 1918....	C 670
Colgrove Charles Henry	Dec. 19th, 1918....	C 679
Cooper, John Andrew	Dec. 19th, 1918....	C 689
Davis, John David	May 16th, 1918....	C 669
Dean, Andrew	Dec. 19th, 1918....	C 688
Farrow, John William	Dec. 19th, 1918....	C 683
Francescini, Louis	May 16th, 1918....	C 672
Gillies, William	May 16th, 1918....	C 668
Herd, William	Dec. 19th, 1918....	C 682
Hilton, Mathias	Dec. 19th, 1918....	C 677
Holdsworth, William	May 16th, 1918....	C 671
Park, William	Dec. 19th, 1918....	C 684
Puckey, John Thomas	Dec. 19th, 1918....	C 687
Shields, Thomas	May 16th, 1918....	C 667
Smith, John Watterson	May 16th, 1918....	C 665
Snow, Aubrey	May 16th, 1918....	C 675
Taylor, Jonathan	Dec. 19th, 1918....	C 680
Tolley, John	Dec. 19th, 1918....	C 678
Webster, James Stewart	Dec. 19th, 1918....	C 685
West, James Gloag	May 16th, 1918....	C 676
Whalley, William	Dec. 19th, 1918....	C 686
Young, Alexander	May 16th, 1918....	C 666

Delinquents from Previous Examinations who have since received Certificates.
First-class Certificates.

Name.	Date.	No.
Davis, Stephen	Nov. 15th, 1917...	

REGISTERED LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY AS COAL-MINE OFFICIALS.

FIRST-CLASS CERTIFICATES—SERVICE CERTIFICATES ISSUED UNDER SECTION 39, "COAL MINES REGULATION ACT, 1877."

Edward G. Prior. James Dunsmuir, Victoria. Thomas A. Buckley.

FIRST-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT, 1897."

NAME.	DATE.
Shepherd, Francis H	March 5th, 1881
Honobin, William	May 1st, 1882
Little, Francis D	May 1st, 1882
Chandler, William	December 21st, 1883
Priest, Elijah	December 21st, 1883
McGregor, James	January 18th, 1888
Randle, Joseph	January 18th, 1888
Matthews, John	January 8th, 1889
Norton, Richard Henry	August 26th, 1889
Bryden, Andrew	December 30th, 1889
Sharp, Alexander	October 27th, 1891
Kesley, John	March 4th, 1892
Wall, William H	May 30th, 1896
Morgan, Thomas	May 30th, 1896
Wilson, David	May 30th, 1896
Smith, Frank B	May 30th, 1896
Bradshaw, George B	June 12th, 1899
Simpson, William G	June 12th, 1899
Hargreaves, James	February 5th, 1901
Drinnan, Robert G	February 5th, 1901
Stockett, Thomas, Jr	August 3rd, 1901
Cunliffe, John	August 3rd, 1901
Evans, Daniel	August 3rd, 1901
McEvoy, James	October 17th, 1902
Wilson, A. R	October 17th, 1902
Simister, Charles	October 17th, 1902
Budge, Thomas	October 17th, 1902
Mills, Thomas	October 17th, 1902
Faulds, Alexander	October 17th, 1902
Richards, James A	October 17th, 1902
McLean, Donald	January 21st, 1905
Wilkinson, Geo	January 21st, 1905
Wright, H. B	January 21st, 1905
Coulthard, R. W	January 21st, 1905
Roaf, J. Richardson	January 21st, 1905
John, John	January 21st, 1905
Manley, H. L	January 21st, 1905
Battey, Richard	May 27th, 1913
Baxter, Andrew	June 10th, 1911

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	NAME.	DATE.
Biggs, J. G	July 22, 1908	McMillan, J. H	Sept. 10, 1910
Bonar, Robert	Oct. 28, 1911	McVicar, Samuel	May 1, 1909
Brace, Tom	May 13, 1915	Mazey, William John	Oct. 31, 1912
Bridge, Edward	July 22, 1908	Miard, Henry Ernest	May 9, 1912
Brown, David	May 21, 1914	Michell, Dudley	Nov. 15, 1917
Brown, Robert Joyce	May 13, 1915	Millar, John K	Nov. 22, 1906
Caufield, Bernard	May 1, 1909	Miller, Andrew Anderson	Oct. 31, 1912
Church, James A. H	June 10, 1911	Montgomery, John W	May 1, 1909
Cox, Richard	May 13, 1915	Moore, Wm. H	May 17, 1917
Crowder, James	June 10, 1911	Mordy, Thomas	Sept. 10, 1910
Cunningham, John Howard	May 9, 1912	Mottishaw, Sam. K	Nov. 15, 1917
Davidson, W. A	May 1, 1909	Musgrove, J. T	Oct. 28, 1911
Davies, David	June 10, 1911	Newton, John	July 22, 1908
Davies, Thos. Owen	May 21, 1914	O'Brien, George	May 21, 1914
de Hart, J. B	May 17, 1917	Ovington, John	May 27, 1913
Derbyshire, James	Nov. 9, 1907	Peacock, Frank David	Oct. 28, 1911
Devlin, Henry	May 1, 1909	Penman, Hugh	May 21, 1914
Dickson, James	Oct. 31, 1912	Phelan, Arthur	May 27, 1913
Elliott, Daniel	Nov. 9, 1907	Powell, J. W	June 10, 1911
Emmerson, Joseph	Nov. 9, 1907	Quinn, John Graham	July 8, 1916
Fairfoull, Robert	June 10, 1911	Ramsay, Peter Millar	May 16, 1918
France, Thos	Nov. 22, 1906	Roper, William	May 13, 1915
Fraser, Norman	Mar. 4, 1905	Russell, John	May 21, 1914
Freeman, H. N	May 1, 1909	Shanks, John	May 1, 1909
Galloway, C. F. J	July 22, 1908	Shaw, Alex	Nov. 14, 1905
Garman, Morris W	Nov. 15, 1917	Shaw, William	May 9, 1912
Gascoyne, Rowland B	May 21, 1914	Shenton, T. J	Sept 10, 1910
Glover, Francis	Oct. 31, 1912	Shone, Samuel	May 1, 1909
Graham, Charles	Nov. 14, 1905	Smith, A. E	Oct. 28, 1911
Graham, Thomas	Nov. 9, 1907	Smith, Joseph	July 22, 1908
Gray, James	Nov. 27, 1909	Smith, Thos. Edwin	Dec. 19, 1918
Henderson, Robert	Nov. 27, 1909	Spicer, J. E	Oct. 28, 1911
Hewlett, Howe	May 27, 1913	Spruston, T. A	Nov. 27, 1909
Higgins, Alexander	Dec. 19, 1918	Stevens, L. C	Nov. 27, 1909
Holden, James	May 1, 1909	Stewart, R. T	Sept. 10, 1910
Howden, Archibald	May 27, 1913	Strachan, Robert	Mar. 4, 1905
Howells, Nathaniel	Oct. 28, 1911	Strang, James	June 10, 1911
Hughes, John C	May 17, 1917	Taylor, James	May 16, 1918
Humphries, Clifford	June 10, 1911	Thomas, J. D	Sept. 10, 1910
Hunter, Alex. B	July 8, 1916	Thorne, B. L	Sept. 10, 1910
Jackson, Thos. R	Nov. 9, 1907	Touhey, James	May 21, 1914
James, William	July 22, 1908	Walker, William	May 16, 1918
Jaynes, Frank	May 13, 1915	Wallbank, J	Sept. 10, 1910
Jemson, Jas. W	May 27, 1913	Warburton, Ernest Leonard	July 8, 1916
Kellock, George	June 10, 1911	Wesnedge, William	Dec. 19, 1918
Knox, T. K	July 27, 1909	Whittaker, John	Dec. 19, 1918
Laird, Robert	Nov. 15, 1917	Williams, John Samuel	Dec. 19, 1918
Lancaster, William	July 22, 1908	Williams, Thos. B	May 17, 1917
Leighton, Henry	May 9, 1912	Williams, Thos. H	Nov. 22, 1906
Macauley, D. A	June 10, 1911	Wilson, Ridgeway R	Nov. 15, 1917
McCulloch, James	Sept. 10, 1910	Wilson, William	May 16, 1918
McGuckie, Thomas	July 22, 1908	Wylie, John	July 22, 1908
McKendrick, Andrew	May 27, 1913		

SECOND-CLASS CERTIFICATES OF SERVICE.

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Lee, John S	March 4, 1905	B 9	Hunt, John	March 4, 1905	B 13
Millar, J. K	March 4, 1905	B 10	Walker, David	March 4, 1905	B 14
McCliment, John	March 4, 1905	B 11	Powell, William Baden	March 4, 1905	B 16
Martin, David	March 4, 1905	B 12	Bryden, Alexander	March 4, 1905	B 18

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Adamson, Robert	Sept. 10, 1910	B 120	Gillespie, Hugh	July 29, 1905	B 24
Allan, Alex. McDairmid	May 27, 1913	B 167	Gillespie, John	Oct. 23, 1906	B 36
Almond, Walter	Nov. 15, 1917	B 213	Gould, Alfred	May 13, 1915	B 190
Barclay, Andrew	July 29, 1905	B 25	Gourlay, Robert	Dec. 19, 1918	B 227
Barlow, Benjamin Robert	Dec. 19, 1918	B 229	Graham, Chas	Mar. 4, 1905	B 1
Baybutt, Thomas	July 8, 1916	B 206	Gray, David	May 1, 1909	B 76
Bell, John	May 17, 1917	B 212	Gray, George	July 8, 1916	B 207
Bevis, Nathaniel	Sept. 10, 1910	B 123	Greenwell, Archibald	May 16, 1918	B 220
Biggs, John	May 1, 1909	B 94	Hamilton, Robert N	May 21, 1914	B 175
Biggs, John G	Nov. 2, 1907	B 40	Hastings, Andrew Peacock	Dec. 19, 1918	B 223
Blair, James	May 13, 1915	B 197	Henderson, Robert	July 22, 1908	B 60
Brace, Tom	Nov. 27, 1909	B 96	Holliday, William	Dec. 19, 1918	B 230
Bridge, Edward	Oct. 23, 1906	B 33	Horrocks, Abner G	June 10, 1911	B 130
Brown, David	Sept. 10, 1910	B 108	Howells, Nathaniel	Nov. 27, 1909	B 97
Brown, George	Dec. 19, 1918	B 225	Huby, Norman W	May 13, 1915	B 198
Brown, James L	Oct. 28, 1911	B 136	Hudson, George	Sept. 10, 1910	B 121
Brown, John C	Oct. 23, 1906	B 39	Hughes, John C	Sept. 10, 1910	B 109
Brown, John Todd	May 9, 1912	B 150	Hutton, Isaac	May 21, 1914	B 185
Brown, R. J	Oct. 28, 1911	B 134	Hutton, John	May 9, 1912	B 154
Brown, Robert	May 21, 1914	B 183	Jackson, Thos. R	Mar. 4, 1905	B 5
Brown, Robert Sneddon	May 13, 1915	B 196	James, David	Nov. 2, 1907	B 58
Brown, William Gold	Dec. 19, 1918	B 228	Jarrett, Fred	May 1, 1909	B 84
Brownrigg, John H	May 17, 1917	B 124	Jaynes, Frank	Sept. 10, 1910	B 111
Bushell, J. P	May 1, 1909	B 81	John, Francis	July 8, 1916	B 200
Carroll, Henry	July 22, 1908	B 62	John, Howell	Sept. 10, 1910	B 122
Caufield, Bernard	Oct. 23, 1906	B 30	Johnson, Moses	May 1, 1909	B 75
Caufield, John	July 8, 1916	B 199	Jones, Samuel	May 16, 1918	B 221
Cawthorne, L	May 1, 1909	B 93	Jones, William T	July 22, 1908	B 66
Challinor, Jno. Thomas	May 27, 1913	B 169	Jordon, Thos	Nov. 27, 1909	B 104
Challoner, Jno. Arthur	May 21, 1914	B 178	Joyce, Walter	May 27, 1913	B 168
Churchill, James	July 22, 1908	B 65	Kirkwood, John Robertson	Oct. 31, 1912	B 160
Clarkstone, Wm. W	May 21, 1914	B 180	Knowles, James E	Oct. 28, 1911	B 137
Commons, Wm.	Sept. 10, 1910	B 115	Laird Robert	May 17, 1917	B 210
Coupland, George	May 16, 1918	B 217	Lancaster, William	Nov. 2, 1907	B 50
Courtney, A. W	Oct. 28, 1911	B 138	Lander, Frank	May 13, 1915	B 195
Cox, Richard	May 9, 1912	B 143	Lane, Joseph	May 9, 1912	B 142
Crawford, David	May 1, 1909	B 88	Lee, Robert John	Sept. 10, 1910	B 110
Cunliffe, Thomas	May 1, 1909	B 78	Littler, Matthew	Oct. 31, 1912	B 157
Dando, John	May 27, 1913	B 164	Luck, George	June 10, 1911	B 128
Daniels, David	Nov. 2, 1907	B 53	Manifold, Albert	May 9, 1912	B 145
Derbyshire, James	Oct. 23, 1906	B 32	Marsh, John	Nov. 15, 1917	B 216
Davidson, Hugh	May 27, 1913	B 165	Mason, Joseph	May 13, 1915	B 193
Davies, Stephen	Sept 10, 1910	B 113	Massey, H	Nov. 27, 1909	B 99
Dennis, Fred. W	May 21, 1914	B 174	Mather, Thomas	June 10, 1911	B 127
Devlin, Ernest H	May 21, 1914	B 179	Matusky, A	May 1, 1909	B 91
Devlin, Henry	Nov. 2, 1907	B 44	Mayer, Ralph Waldo	May 9, 1912	B 144
Dewar, Alexander	Oct. 31, 1912	B 162	Mazay, W. J	Nov. 27, 1909	B 101
Dickenson, Clifford	May 13, 1915	B 189	Merryfield, William	July 22, 1908	B 61
Dunsmuir, John	Nov. 14, 1905	B 26	Miard, Hy. E	Sept. 10, 1910	B 107
Dykes, J. W	May 1, 1909	B 77	Michek, John	May 17, 1917	B 188
Eccleston, Wm	May 1, 1909	B 87	Michell, Dudley	May 13, 1915	B 187
Ewart, Alexander	May 17, 1917	B 208	Middleton, Robert	July 22, 1908	B 72
Fairfoull, James	May 21, 1914	B 186	Mitchell, Henry	July 8, 1916	B 201
Fairfoull, R	May 1, 1909	B 83	Monks, James	Nov. 2, 1907	B 55
Finlayson, James	July 29, 1905	B 21	Moore, Wm. H	May 21, 1914	B 173
Ford, Allan	May 27, 1913	B 171	Morgan, John	Nov. 2, 1907	B 43
Foster, W. R	Nov. 27, 1909	B 102	Morgan, William	Dec. 19, 1918	B 224
France, Thos	May 14, 1905	B 27	Morris, John	July 22, 1908	B 67
Francis, David M	May 21, 1914	B 182	Morton, Robert W	July 22, 1908	B 59
Francis, Enoch	May 1, 1909	B 86	Mottishaw, S. K	Oct. 28, 1911	B 135
Francis, James	July 22, 1908	B 63	Musgrave, J	May 1, 1909	B 90
Frater, George	July 8, 1916	B 204	Myers, Peter	May 9, 1912	B 149
Freeman, Henry N	Nov. 2, 1907	B 45	McDonald, J. A	Oct. 28, 1911	B 133
Garbett, Richard	Oct. 31, 1912	B 161	McDonald, John	May 27, 1913	B 172
Garman, Morris Wilbur	Oct. 31, 1912	B 155	McFegan, W	Nov. 31, 1909	B 106

Second-class Certificates of Competency issued under "Coal Mines Regulation Act Further Amendment Act, 1904"—*Concluded.*

Name.	Date.	Cer. No.	Name.	Date.	Cer. No.
McGarry, Martin	Oct. 31, 1912	B 156	Shaw, Alex	July 29, 1905	B 19
McGuckie, Thomas M.	Oct. 23, 1906	B 35	Shaw, Thomas John	May 27, 1913	B 166
McKelvie, J.	May 1, 1909	B 92	Somerville, Alex.	Mar. 4, 1905	B 4
McKendrick, And.	Sept. 10, 1910	B 112	Spruston, Robert Lecce.	July 8, 1916	B 202
McMillan, D.	June 10, 1911	B 125	Spruston, Thos. A.	Nov. 2, 1907	B 46
McNay, Carmichael.	May 9, 1912	B 151	Stafford, Matthew	June 10, 1911	B 131
McPherson, James E.	July 22, 1908	B 73	Stewart, J. M.	May 1, 1909	B 95
Neen, Joseph	June 10, 1911	B 129	Stobbart, Jacob.	May 9, 1912	B 153
Newbury, Arthur	May 21, 1914	B 184	Stockwell, William	Nov. 2, 1907	B 56
Newton, John	Oct. 23, 1906	B 31	Strang, Thomas	Oct. 31, 1912	B 158
Newton, Wm.	Sept. 10, 1910	B 116	Sutherland, John	May 16, 1918	B 218
O'Brien, Charles	May 9, 1912	B 148	Taylor, James	May 13, 1915	B 194
O'Brien, George	May 1, 1909	B 82	Taylor, Thomas	July 8, 1916	B 203
Ovington, John	Nov. 2, 1907	B 52	Thomas, J. B.	Nov. 27, 1909	B 105
Parkinson, T.	May 1, 1909	B 80	Thomas, Joseph D.	Oct. 23, 1906	B 38
Parnham, Charles	Nov. 2, 1907	B 49	Thompson, Joseph	Sept. 10, 1910	B 114
Quinn, James	May 21, 1914	B 181	Touhey, James	May 9, 1912	B 147
Quinn, John	May 9, 1912	B 146	Touhey, William	July 8, 1916	B 205
Ramsay, Peter Millar	May 17, 1917	B 209	Tonge, Thomas	July 22, 1908	B 71
Rankin, Geo.	Nov. 27, 1909	B 103	Tully, Thomas	Nov. 15, 1917	B 214
Raynes, M. T.	Oct. 28, 1911	B 139	Vanhulle, Peter.	Nov. 2, 1907	B 54
Reid, Wm.	Oct. 28, 1911	B 132	Virgo, John	May 1, 1909	B 89
Renny, James	Oct. 28, 1911	B 140	Walker, William	May 13, 1915	B 192
Richards, Thomas.	Nov. 2, 1907	B 57	Warburton, Ernest L.	May 27, 1913	B 170
Richards, Samuel	May 9, 1912	B 152	Watson, Adam G.	Nov. 14, 1905	B 28
Rigby, John	July 29, 1905	B 29	Watson, Arthur W.	May 17, 1917	B 211
Roberts, Ebenezer	Sept. 10, 1910	B 117	Webber, John Frank	Mar. 4, 1905	B 3
Robinson, William	July 22, 1908	B 69	Wesnedge, William	Nov. 27, 1909	B 98
Rogers, George	May 1, 1909	B 79	White, John	Nov. 2, 1907	B 48
Roper, William.	May 9, 1912	B 141	Whitehouse, William	Oct. 31, 1912	B 163
Rowbottom Thomas.	May 16, 1918	B 222	Williams, John Samuel.	Nov. 15, 1917	B 215
Russell, John	Nov. 2, 1907	B 47	Wilson, Robinson.	May 21, 1914	B 177
Rutherford, Jasper.	May 16, 1918	B 219	Wilson, Thomas	July 22, 1908	B 74
Saville, Luther.	May 2, 1907	B 51	Wilson, William	July 22, 1908	B 70
Scarpino, Francis.	Dec. 19, 1918	B 226	Wood, Thos. James.	May 21, 1914	B 176
Shanks, David.	Oct. 31, 1912	B 159	Worthington, Joseph.	May 1, 1909	B 85

Third-class Certificates issued under "Coal Mines Regulation Act Further Amendment Act, 1904."

Name.	Date.	Cer. No.	Name.	Date.	Cer. No.
Adamson, Robert	May 1, 1909	C 323	Bateman, Joseph William.	Oct. 28, 1913	C 551
Ainsworth, Edward	May 16, 1918	C 674	Bauld, Wm	June 10, 1911	C 422
Allan, Alexander	Oct. 28, 1911	C 430	Baxter, Robert.	Oct 28, 1911	C 450
Almond, Alex.	Oct. 1, 1907	C 252	Baybutt, Thomas.	May 27, 1913	C 548
Almond, Walter	July 22, 1908	C 286	Beeton, D. H.	May 1, 1909	C 338
Anderson, John.	Oct. 28, 1911	C 437	Bell, Fred	May 27, 1913	C 514
Anderson, Peter Blane	Nov. 15, 1917	C 660	Bell, John	May 9, 1912	C 477
Anderson, Robt.	Oct. 14, 1914	C 599	Bennett, Andrew M.	Nov. 15, 1917	C 661
Angell, William	May 21, 1914	C 591	Bennett, John.	Oct. 14, 1914	C 597
Arbuckle, John.	May 13, 1915	C 622	Bennie, John.	June 10, 1911	C 411
Archibald, Geo.	May 21, 1914	C 569	Beveridge, Wm.	June 10, 1911	C 396
Archibald, Thomas.	Oct. 28, 1911	C 454	Biggs, John.	Mar. 4, 1905	C 210
Ball, Alfred	May 17, 1917	C 635	Biggs, Thomas	Oct. 28, 1911	C 449
Bann, Thomas.	Oct. 31, 1912	C 494	Birchell, Richard.	Oct. 1, 1907	C 266
Baggaley, J.	July 22, 1908	C 300	Blair, James	Oct. 31, 1912	C 502
Bain, James	May 27, 1913	C 546	Blewett, Ernest	July 22, 1908	C 298
Ball, Benjamin	May 21, 1914	C 583	Blinkhorn, Thomas	Dec. 19, 1918	C 681
Barker, Robert	June 10, 1911	C 415	Bradley, William.	July 22, 1908	C 291
Barlow, B. R.	May 1, 1909	C 337	Bridge, Edward	July 29, 1905	C 223

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Briscoe, F.	July 22, 1908	C 309	Doney, John	Mar. 4, 1905	C 211
Broderick, Matthew	Jan. 21, 1913	C 525	Donnachie, John	June 10, 1911	C 425
Brown, Arthur A.	Oct. 14, 1914	C 596	Doodson, Robert	Oct. 28, 1911	C 455
Brown, David	Nov. 1, 1909	C 348	Dorrance, Orlin William	Jan. 21, 1913	C 517
Brown, George	July 8, 1916	C 626	Douglas, D. B.	Oct. 23, 1906	C 235
Brown, James	Sept. 10, 1910	C 364	Dow, And. Y.	May 21, 1914	C 587
Brown, James	June 10, 1911	C 412	Dunn, Wm.	Oct. 14, 1914	C 606
Brown, James	July 8, 1916	C 625	Dykes, Isaac	June 10, 1911	C 409
Brown, Jas. Millie	May 13, 1915	C 615	Dykes, Joseph W.	Oct. 1, 1907	C 248
Brown, John	Sept. 10, 1910	C 392	Eccleston, Thomas	May 17, 1917	C 482
Brown, Robert	Oct. 28, 1911	C 451	Edwards, John	May 27, 1913	C 542
Brown, Robert D.	June 10, 1911	C 423	Elliott, John	May 27, 1913	C 541
Brown, Robert S.	June 10, 1911	C 408	Elmes, George	Oct. 31, 1912	C 511
Brown, Wm. A.	May 21, 1914	C 576	Evans, D.	July 22, 1908	C 284
Brown, William Gold	July 8, 1916	C 629	Ewart, Alex.	Sept. 10, 1910	C 374
Brownrigg, J. H.	July 22, 1908	C 276	Ewing, Robert	May 13, 1915	C 608
Bullen, Thomas	Sept. 10, 1910	C 379	Fairfoull, James	Oct. 28, 1911	C 453
Bushell, Jas. P.	Oct. 1, 1907	C 264	Farrow, John William	Dec. 19, 1918	C 683
Bysouth, Thomas	May 16, 1918	C 673	Fitzpatrick, T. J	Oct. 2, 1911	C 452
Cairns, Andrew	June 10, 1911	C 420	Flockart, David	Jan. 21, 1913	C 531
Cairns, Robert	May 27, 1913	C 539	Ford, Allen	Oct. 28, 1911	C 445
Caldwell, Daniel	May 17, 1917	C 639	Fowler, Robert	Oct. 31, 1912	C 495
Calverly, Joseph	Sept. 10, 1910	C 375	Francescini, Louis	May 16, 1918	C 672
Camamile, Hollis	Oct. 28, 1911	C 443	Francis, David Morgan	Oct. 28, 1913	C 558
Campbell, Samuel	Nov. 15, 1917	C 662	Francis, James	Oct. 1, 1907	C 250
Carr, Peter	Oct. 31, 1912	C 497	Frater, George	May 13, 1915	C 616
Carson, George	Mar. 17, 1917	C 663	Freeman, H. N.	Nov. 14, 1905	C 230
Catchpole, Charles	July 29, 1905	C 227	Frew, Andrew	Nov. 27, 1909	C 360
Caufield, Edward	May 16, 1918	C 670	Frodsham, Vincent	July 22, 1908	C 282
Caufield, John	May 1, 1909	C 321	Furbow, John	Jan. 21, 1913	C 528
Challoner, Arthur	Oct. 28, 1911	C 433	Garbett, Richard	Sept. 10, 1910	C 377
Charnock, John	Nov. 15, 1917	C 653	Gascoyne, Rowland B.	Jan. 21, 1913	C 513
Cheetham, Ben	July 22, 1908	C 311	Geater, Jas. Gordon	May 21, 1914	C 573
Chester, John	Oct. 28, 1911	C 440	Gemmell, James	Oct. 31, 1912	C 505
Clark, Lewis	June 10, 1911	C 405	Gillham, John	May 13, 1915	C 623
Clark, Walter Pattison	May 9, 1912	C 480	Gillies, William	May 16, 1918	C 668
Clarkstone, Wm. W.	Oct. 28, 1911	C 431	Glenn, James	Oct. 28, 1911	C 435
Cleaves, Walter	May 9, 1912	C 475	Gordon, Davis John	May 9, 1912	C 474
Clifford, William	July 22, 1908	C 313	Gourley, Robert	May 9, 1912	C 470
Colgrove, Charles Henry	Dec. 19, 1918	C 679	Gray, George	May 9, 1912	C 467
Commons, William	July 22, 1908	C 304	Green, William	Nov. 15, 1917	C 659
Cooke, Joseph	Mar. 4, 1905	C 209	Greenhorn, John	May 21, 1914	C 575
Coomb, Alexander	May 27, 1913	C 533	Griffiths, Edward	Oct. 31, 1914	C 508
Cooper, John Andrew	Dec. 19, 1918	C 689	Gunniss, Matthew	May 9, 1912	C 460
Cope, Frank	Oct. 28, 1913	C 549	Hallinan, William	May 1, 1909	C 343
Coulthard, James	June 10, 1911	C 407	Halsall, J.	July 22, 1908	C 307
Crawford, David	Mar. 4, 1905	C 208	Hamilton, John	Oct. 28, 1911	C 444
Cunningham, G. F.	Nov. 11, 1905	C 229	Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550
Cunliffe, Thos	Oct. 1, 1907	C 265	Hampton, Samuel	Nov. 15, 1917	C 650
Dabb, Owen	May 21, 1914	C 578	Hancock, Arthur	Nov. 15, 1917	C 656
Dando, John	May 9, 1912	C 465	Hartley, Thomas	Oct. 31, 1912	C 510
Davidson, Hugh	May 9, 1912	C 464	Harwood, Fred	Sept. 10, 1910	C 384
Davies, Evan Thomas	May 9, 1912	C 463	Harvey, Thomas	May 9, 1912	C 466
Davis, John David	May 16, 1918	C 669	Harvie, George	Sept. 10, 1910	C 378
Davis, William	May 1, 1909	C 339	Heaps, Robert	Sept. 10, 1910	C 373
Dean, Andrew	Dec. 19, 1918	C 688	Hemer, Herbert	Oct. 14, 1914	C 595
Dean, Joseph	May 13, 1915	C 611	Henney, Jonathan	June 10, 1911	C 424
Derbyshire, A.	June 10, 1911	C 401	Hendry, James	May 9, 1912	C 471
Dewar, Alex.	Sept. 10, 1910	C 369	Herd, William	Dec. 19, 1918	C 682
Devlin, Edward	Oct. 23, 1906	C 241	Heyes, Edward	May 1, 1909	C 320
Devlin, Ernest Henry	May 27, 1913	C 538	Hill, Isaac	Nov. 15, 1917	C 664
Devoy, William	May 17, 1917	C 638	Hilley, Fred	July 22, 1908	C 290
Dickenson, Clifford	May 27, 1917	C 532	Hilton, Mathias	Dec. 19, 1918	C 677
Dingsdale, Geo.	Oct. 28, 1911	C 459	Hilton, R. G.	Sept. 10, 1910	C 376
Doherty, J. J.	May 1, 1909	C 340	Hodson, R. H.	Mar. 4, 1905	C 216

Third-class Certificates issued under "Coal Mines Regulation Act Further Amendment Act, 1904"—*Continued.*

Name.	Date.	Cer. No.	Name.	Date.	Cer. No.
Holdsworth, William	May 16, 1918	C 671	Maxwell, Geo.	May 21, 1914	C 571
Holliday, William	July 8, 1916	C 634	McAlpine, John	Mar. 4, 1905	C 217
Horbury, Joseph W.	June 10, 1911	C 406	McArthur, John Malcolm	May 17, 1917	C 648
Horrocks, A. G.	May 1, 1909	C 324	McBroom, Al.	July 2, 1908	C 287
Horwood, S	July 22, 1908	C 312	McCourt, John	Oct. 14, 1914	C 605
Houston, Robert	July 8, 1916	C 631	McCulloch, James	May 1, 1909	C 315
Howells, Nathaniel	May 1, 1909	C 316	McDonald, John	Oct. 28, 1911	C 448
Huby, Norman	June 10, 1911	C 394	McFagen, Alexander	May 9, 1912	C 490
Hutchison, Ben	Nov. 14, 1905	C 232	McFegan, W.	May 1, 1909	C 319
Hutchison, Fred.	Nov, 27, 1909	C 358	McGarry, Martin	May 1, 1909	C 326
Hynds, William	July 8, 1916	C 632	McGrath, James	July 8, 1916	C 630
Ireson, John	Oct. 31, 1912	C 507	McGuckie, Jno. M	May 21, 1914	C 562
Irvine, David	June 10, 1911	C 413	McGuckie, Thomas	July 29, 1905	C 226
Jack, John	May 21, 1914	C 582	McGuire, Thomas	Oct. 28, 1913	C 553
James, Thos.	May 21, 1914	C 588	McIntyre, Neil	May 21, 1914	C 574
Jardine, George Edward	Jan. 21, 1913	C 521	McKelvie, J.	July 22, 1908	C 285
Jarrett, Fred. J.	Oct. 1, 1907	C 256	McKenzie, Peter	June 10, 1911	C 427
Jaynes, Frank	July 22, 1908	C 277	McKibben, Matthew	May 21, 1914	C 580
Jenson, J. W	Mar. 4, 1905	C 205	McKinley, John	Oct. 28, 1914	C 442
Jenkins, John	Sept. 10, 1910	C 390	McLaughlin, James	May 9, 1912	C 485
John, Howel	July 22, 1908	C 305	McLachlan, Alex	June 10, 1912	C 419
Johnson, Moses.	Oct. 1, 1907	C 258	McLean, M. D	Sept. 10, 1910	C 389
Johnston, Robert	May 9, 1912	C 479	McLellan, William	Mar. 4, 1905	C 219
Jones, Alf. Geo.	May 21, 1914	C 584	McLeod, James	July 22, 1908	C 296
Jones, Samuel	May 27, 1913	C 518	McLeod, John	May 13, 1915	C 609
Jones, William C.	Jan. 21, 1913	C 556	McMeakin, James	May 13, 1915	C 612
Jones, William Ernest	Oct. 28, 1913	C 221	McMillan, D	Sept. 10, 1910	C 363
Jones, W. T.	Mar. 4, 1905	C 544	McMillan, Edward	Oct. 31, 1912	C 493
Joyce, Walter	Nov. 27, 1909	C 361	McMillan, Neil.	Nov. 15, 1917	C 654
Judge, Peter	Sept. 10, 1910	C 391	McNay, Carmichael	July 22, 1908	C 306
Keenan, Wm. James	June 10, 1911	C 426	McNeill, Adam L.	July 22, 1908	C 281
Kelly, Ernest	May 17, 1917	C 646	McNeill, Robert	Sept. 10, 1910	C 387
Kemp, Wm.	Oct. 14, 1914	C 594	Meek, Matthew	May 9, 1912	C 484
Kingham, Alfred	Oct. 28, 1913	C 559	Meikle, Harry Alexander	July 8, 1916	C 627
Kirkeberg, H. S.	Nov. 27, 1909	C 350	Mercer, Jas.	Oct. 14, 1914	C 600
Lancaster, William	Oct. 23, 1906	C 243	Merrifield, George.	Oct. 23, 1906	C 239
Lane, Joseph	Oct. 1, 1907	C 254	Merrifield, William	Oct. 23, 1906	C 236
Leeman, T.	May 1, 1909	C 345	Michek, John.	May 21, 1914	C 563
Lewis, Benj. J	Sept. 10, 1910	C 386	Miles, John	June 10, 1911	C 414
Leynard, Paul	May 17, 1917	C 637	Mitchell, Charles.	May 1, 1909	C 322
Liddle, John	July 29, 1905	C 228	Mitchell, Henry	Sept. 10, 1910	C 366
Lindsay, William	May 17, 1917	C 642	Monks, James	Nov. 14, 1905	C 234
Littler, John	June 10, 1911	C 410	Moore, George.	Oct. 23, 1906	C 242
Littler, Matthew	June 10, 1911	C 417	Moore, John.	May 1, 1909	C 335
Littler, Robert.	June 10, 1911	C 418	Moreland, Thomas	July 22, 1908	C 299
Livingstone, Alex.	Oct. 28, 1911	C 436	Morgan, John	July 29, 1905	C 224
Loxton, George.	June 10, 1911	C 428	Morgan, William.	May 17, 1917	C 636
Loxton, John	June 10, 1911	C 416	Morris, David	May 9, 1912	C 472
Luck, George.	May 1, 1909	C 318	Mottishow, Samuel K	Oct. 23, 1906	C 237
Lynch, Stewart	Oct. 28, 1911	C 432	Murdock, Jno. Y.	May 21, 1914	C 564
Mackie, John.	June 10, 1911	C 421	Myers, Peter	Oct. 28, 1911	C 446
Makin, J. Wm.	Sept. 10, 1910	C 385	Nanson, T. H.	July 22, 1908	C 280
Malone, John.	May 21, 1914	C 585	Nash, George William.	May 17, 1917	C 565
Malone, Patrick	Oct. 1, 1907	C 247	Neen, Joseph	Nov. 27, 1909	C 352
Maltman, James	Oct. 31, 1912	C 501	Nelson, Horatio.	Oct. 1, 1907	C 263
Mansfield, A	May 1, 1909	C 336	Neilson, William	May 9, 1912	C 481
Marrs, John	May 17, 1917	C 640	Newman, John	Oct. 14, 1914	C 603
Marsh, Daniel Parks	May 27, 1913	C 543	Nicholson, James	May 9, 1912	C 469
Marsh, John	Oct. 1, 1907	C 270	Nimmo, James	May 9, 1912	C 461
Martin, James	June 10, 1911	C 398	Norris, Joshua	Oct. 28, 1913	C 557
Mason, Joseph.	July 22, 1908	C 297	Oakes, Robert	Oct. 31, 1912	C 498
Massey, Henry	May 1, 1909	C 317	O'Brien, Charles	Nov. 27, 1909	C 349
Mather, Thomas	July 22, 1908	C 293	Odgers, Alfred	Jan. 21, 1913	C 529
Matusky, Andrew.	Oct. 1, 1907	C 259	Odgers, Eli	Jan. 21, 1913	C 523
Mawson, J. T	Nov. 27, 1909	C 359	Orr, Alexander	Oct. 28, 1911	C 434

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Osborne, Hugh	Oct. 28, 1913	C 555	Skelton, Thos	May 1, 1909	C 344
Oswald, Geo. L.	Sept. 10, 1910	C 370	Smith, A. E.	Sept. 10, 1910	C 367
Owen, Thomas	May 1, 1909	C 347	Smith, John Watterson	May 16, 1918	C 665
Park, William	Dec. 19, 1918	C 684	Smith, Joseph	Mar. 4, 1905	C 207
Parks, Alexander	Jan. 21, 1913	C 519	Smith, Richard Beveridge	Oct. 28, 1913	C 561
Parker, L.	May 1, 1909	C 341	Smith, Thos. J.	Oct. 1, 1907	C 271
Parkinson, James William	Nov. 15, 1917	C 655	Smith, Thomas	May 9, 1912	C 486
Parkinson, T.	July 22, 1908	C 289	Snow, Aubrey	May 16, 1918	C 675
Parrott, Jas. E.	May 21, 1914	C 590	Sopwith, Reginald Scott	Jan. 21, 1913	C 512
Parson, Herbert	May 13, 1915	C 621	* Sparks, Edward	Oct. 1, 1907	C 255
Pearson, Jonathan	May 9, 1912	C 473	Spencer, G.	May 1, 1909	C 329
Penman, Hugh	Oct. 28, 1913	C 552	Spruston, R. L.	Nov. 27, 1909	C 355
Perry, George Harewood	May 17, 1917	C 643	Spruston, Thomas A	Mar. 4, 1905	C 206
Phillips, Richard Stephen	May 17, 1917	C 620	Stafford, M.	Sept. 10, 1910	C 382
Pickup, A.	July 22, 1908	C 310	Starr, Wallace	May 9, 1912	C 488
Picton, W.	May 1, 1909	C 333	Staton, Edward	May 21, 1914	C 581
Plank, Samuel	Nov. 14, 1905	C 233	Steele, Walter	Oct. 28, 1911	C 439
Poole, Samuel	May 27, 1913	C 536	Stewart, George	May 27, 1913	C 534
Price, Walter	Sept. 10, 1910	C 371	Stewart, James M.	Oct. 23, 1906	C 240
Puckey, John Thomas	Dec. 19, 1918	C 687	Stockwell, William	Oct. 23, 1906	C 238
Quinn, James	Oct. 28, 1911	C 441	Strachan, John	Oct. 14, 1914	C 604
Quinn, John	Oct. 28, 1911	C 429	Strang, James	May 13, 1915	C 614
Radford, Albert	May 21, 1914	C 579	Strang, Thomas	June 10, 1911	C 400
Rallison, R.	July 22, 1908	C 279	Strang, Wm.	June 10, 1911	C 395
Rankin, George	July 22, 1908	C 275	Sutherland, John	May 27, 1913	C 545
Rankin, Wm. Shaw	May 9, 1912	C 489	Taylor, Charles M.	Mar. 4, 1905	C 213
Ratcliffe, Thomas	Oct. 1, 1907	C 253	Taylor, Hugh	Jan. 21, 1913	C 530
Raynor, Fred	Oct. 1, 1907	C 257	Taylor, James	May 21, 1914	C 567
Reid, Robert	Sept. 10, 1910	C 383	Taylor, Jonathan	Dec. 19, 1918	C 680
Reid, Thos.	May 21, 1914	C 592	Taylor, J. T.	Oct. 28, 1911	C 447
Reid, Wm.	June 10, 1911	C 403	Taylor, Leroy	Sept. 10, 1910	C 381
Reilly, Thomas	July 22, 1908	C 303	Taylor, Thomas	May 21, 1914	C 577
Renney, Jas.	Nov. 27, 1909	C 354	Thacker, Geo.	May 27, 1913	C 537
Richards, James	Nov. 1, 1907	C 249	Thomas, Thomas	Sept. 10, 1910	C 365
Richards, Samuel	Oct. 23, 1906	C 244	Thomas, John B.	Nov. 14, 1905	C 231
Richardson, J. H.	Oct. 28, 1911	C 458	Thomas, Joseph	Mar. 4, 1905	C 220
Rigby, John	July 29, 1905	C 225	Thomas, Warriett	Oct. 1, 1907	C 273
Roberts, Ebenezer	May 1, 1909	C 327	Thomason, Charles	Nov. 15, 1917	C 657
Robinson, Michael	May 1, 1909	C 332	Thompson, Thomas	Oct. 1, 1917	C 267
Robson, Thomas	May 21, 1914	C 566	Thompson, John	Oct. 31, 1912	C 509
Rogers, Ellis	May 13, 1915	C 624	Thompson, Joseph	Oct. 1, 1907	C 269
Roper, William	July 22, 1908	C 274	Thomson, Duncan	Mar. 4, 1905	C 218
Rowan, Alexander	Oct. 31, 1912	C 500	Tolley, John	Dec. 19, 1918	C 678
Rowan, John	Oct. 14, 1914	C 602	Touhey, William	May 27, 1913	C 547
Rowbottom, Thomas	Oct. 31, 1914	C 492	Tully, Thomas	May 9, 1912	C 468
Royle, Edward	Oct. 31, 1912	C 506	Tune, Elijah	May 9, 1912	C 476
Russell, Robert	Nov. 27, 1909	C 351	Turnbull, Matthew	Oct. 14, 1914	C 598
Rutherford, Jasper	May 17, 1917	C 644	Vardy, Robt.	May 21, 1914	C 570
Rutledge, Edwin	July 22, 1908	C 302	Vaughan, John Henry	Oct. 28, 1913	C 560
Scott, Henry	July 22, 1908	C 294	Walker, George	July 8, 1916	C 633
Saunders, Eustace L.	Jan. 21, 1913	C 520	Walker, Jas. Alexander	Oct. 31, 1912	C 496
Scarpino, Francis	May 17, 1917	C 649	Walker, Wm.	May 21, 1914	C 586
Seggie, Robert	Jan. 21, 1913	C 524	Wallace, Fred	Oct. 1, 1907	C 260
Shanks, David	Sept. 10, 1910	C 372	Warburton, Ernest Leonard	June 10, 1911	C 399
Sharp, James	May 1, 1909	C 325	Ward, Ernest Hedley	May 17, 1917	C 641
Sharples, J. T.	Sept. 10, 1910	C 380	Wardrop, James	Oct. 31, 1912	C 504
Shearer, L.	May 1, 1909	C 330	Watson, Adam G	Mar. 4, 1905	C 212
Shields, Thomas	May 16, 1918	C 667	Watson, Arthur W.	May 27, 1913	C 535
Shipley, John W.	Oct. 28, 1911	C 456	Watson, George	July 22, 1908	C 288
Shooter, Joseph	Oct. 1, 1907	C 261	Watson, Joseph	Jan. 21, 1913	C 515
Shortman, J.	May 1, 1909	C 331	Watson, William	Oct. 22, 1906	C 246
Simister, J. H.	Nov. 27, 1909	C 353	Watson, William	May 17, 1917	C 645
Simister, W.	May 1, 1909	C 334	Webb, Herbert	Oct. 28, 1911	C 457
Simms, Hubert Allan	Jan. 21, 1913	C 526	Webster, James Stewart	Dec. 19, 1918	C 685
Sinclair, William	Jan. 21, 1913	C 527	Weeks, John	Mar. 4, 1905	C 214

* C 314 issued in lieu of C 255 destroyed by Fernie fire.

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Concluded.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
West, James Gloag	May 16, 1918	C 676	Wilson, William	May 17, 1917	C 647
Whalley, William	Dec. 19, 1918	C 686	Winstanley, H.	July 22, 1908	C 283
White James	Oct. 31, 1912	C 499	Wintle, Thomas A	July 29, 1905	C 222
White, John	Oct. 22, 1906	C 245	Witherington, George	Oct. 28, 1913	C 554
Whitehouse, Wm.	June 10, 1911	C 402	Wood, Thos. James	Oct. 31, 1912	C 491
Wilkinson, Edward	Oct. 28, 1911	C 438	Worthington, J.	July 22, 1908	C 295
Williams, John Sam.	June 10, 1911	C 404	Wright, John	May 21, 1914	C 593
Williams, Watkin	June 22, 1908	C 301	Wright, Robert	May 21, 1914	C 589
Wilson, Robinson.	June 10, 1911	C 397	Wright, William	Jan. 21, 1913	C 522
Wilson, Thomas M.	Oct. 1, 1907	C 272	Young, Alexander	May 16, 1918	C 666
Wilson, William	Oct. 1, 1907	C 262			

COAL-MINE OFFICIALS.

Third-class Certificates issued under "Coal Mines Regulation Act Further Amendment Act, 1904," sec. 38, subsec. (2), in exchange for Certificates issued under the "Coal Mines Regulation Act Amendment Act, 1901."

Name.	Date.	Certificate No.	Name.	Date.	Certificate No.
Adam, Robert	Oct. 12, 1904	C 42	Lewis, Thos	Oct. 11, 1904	C 35
Addison, Thos	Dec. 10, 1904	C 52	Malpass, James	Nov. 7, 1904	C 113
Aitken, James	Oct. 24, 1904	C 44	Marsden, John	May 3, 1904	C 21
Allsop, Harry	Oct. 11, 1904	C 34	Miard, Harry E	March 3, 1905	C 76
Ashman, Jabez	Feb. 5, 1907	C 131	Middleton, Robt	Feb. 11, 1905	C 71
Auchinvole, Alex	March 29, 1905	C 89	Miller, Thos. K	Feb. 21, 1905	C 74
Barclay, Andrew	April 27, 1904	C 19	McKenzie, John R	Oct. 12, 1904	C 40
Barclay, James	April 27, 1904	C 20	McKinnon, Arch'd	April 3, 1905	C 102
Barclay, John	April 17, 1905	C 111	McMillan, Peter	March 29, 1905	C 94
Bickle, Thos	Oct. 11, 1904	C 37	McMurtrie, John	March 29, 1905	C 96
Bowie, James	May 13, 1905	C 116	Moore, Wm. H	June 17, 1905	C 119
Briscoe, Edward	Oct. 10, 1906	C 129	Morris, John	Dec. 27, 1904	C 57
Campbell, Dan	March 29, 1905	C 93	Myles, Walter	April 3, 1905	C 100
Carr, Jos. E	Oct. 11, 1904	C 36	Nash, Isaac	June 1, 1904	C 120
Carroll, Harry	March 29, 1905	C 98	Neave, Wm	Oct. 12, 1904	C 43
Clarkson, Alexander	April 27, 1904	C 18	Nelson, James	April 27, 1904	C 16
Collishaw, John	Feb. 7, 1905	C 68	Newton, John	Oct. 12, 1904	C 39
Comb, John	March 23, 1904	C 2	Nimmo, Jas. P	April 3, 1905	C 103
Cosier, Wm	March 29, 1905	C 86	Nimmo, Richard E	April 18, 1911	C 133
Courtney, A. W	Nov. 2, 1904	C 45	O'Brien, Geo	Feb. 6, 1905	C 66
Crawford, Frank	April 6, 1904	C 7	Pearse, Thomas W. H	April 14, 1916	C 138
Daniels, David	April 27, 1904	C 12	Perrie, James	March 15, 1905	C 81
Davidson, David	April 3, 1905	C 106	Price, Jas	Nov. 8, 1904	C 50
Davidson, John	March 29, 1905	C 87	Rafter, Wm	March 29, 1905	C 95
Devlin, Henry	Oct. 12, 1904	C 41	Reid, James	March 23, 1904	C 1
Dobbie, John	Nov. 27, 1905	C 126	Richards, Thos	April 27, 1904	C 14
Dudley, James	March 22, 1905	C 114	Ross, John	April 3, 1905	C 101
Duncan, Thomas	Aug. 29, 1906	C 128	Roughead, George	Jan. 30, 1907	C 130
Dunlap, Henry	Nov. 21, 1904	C 51	Ryan, John	Dec. 28, 1904	C 59
Dunn, Geo	Dec. 19, 1904	C 56	Sanders, John W	April 3, 1905	C 107
Dunsmuir, John	March 29, 1905	C 90	Shenton, Thos. J	July 25, 1904	C 30
Eccleston, Wm	March 15, 1905	C 80	Shepherd, Henry	June 13, 1904	C 26
Fagan, David	April 6, 1905	C 109	Smith, Geo	March 29, 1905	C 84
Farquharson, John	April 27, 1904	C 17	Somerville, Alex	March 24, 1904	C 3
Findlayson, James	June 6, 1904	C 25	Stauss, Chas. F	Feb. 9, 1905	C 69
Fulton, Hugh T	April 3, 1905	C 105	Steele, Jas	March 29, 1905	C 92
Gibson, Edward	May 30, 1905	C 118	Steele, John	June 4, 1913	C 4
Gilchrist, Wm	March 29, 1905	C 85	Stewart, Duncan H	March 28, 1904	C 137
Gillespie, Hugh	April 6, 1904	C 8	Stewart, John	April 3, 1904	C 104
Gillespie, John	April 6, 1904	C 5	Stewart, Daniel W	May 16, 1904	C 23
Gould, Alfred	April 17, 1906	C 112	Stoddart, Jacob	Feb. 21, 1905	C 73
Green, Francis	Oct. 11, 1904	C 38	Strachan, Robt	April 27, 1904	C 15
Handlen, Jas	June 16, 1904	C 122	Strang, James	April 27, 1904	C 10
Harmison, Wm	Feb. 3, 1905	C 65	Sullivan, John	July 4, 1916	C 139
Hescott, John	Jan. 16, 1905	C 62	Thomas, John	March 29, 1905	C 97
Hoggan, Wm	June 6, 1911	C 134	Vass, Robt	Dec. 12, 1904	C 53
John, David	Nov. 8, 1904	C 49	Vater, Charles	April 6, 1904	C 66
John, Evan	July 25, 1916	C 140*	Webber, Chas	Sept. 13, 1904	C 32
Johnson, Geo	May 9, 1904	C 124	Webber, Charles F	Sept. 13, 1904	C 33
Johnson, Wm. R	March 1, 1905	C 75	Whiting, Geo	May 29, 1905	C 117
Jones, Evan	April 30, 1913	C 136	Wilson, Austin	Feb. 7, 1905	C 67
Kerr, Wm	March 29, 1905	C 91	Wilson, Thos	April 27, 1904	C 11
Lander, Frank	Jan. 9, 1905	C 61	Woodburn, Moses	March 29, 1905	C 83
Lanfear, Herbert	Jan. 27, 1905	C 63	Yarrow, Geo	Nov. 3, 1904	C 46

* Issued in lieu of No. C 132, lost.

INSPECTION OF METALLIFEROUS MINES.

WEST KOOTENAY AND BOUNDARY DISTRICTS.

Report of James McGregor, Inspector.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for West Kootenay and Boundary Districts for the year 1918.

Nelson District.

This has not been a busy year in mining throughout this district, nothing new of importance having been opened. Diamond-drilling and other development-work has been carried on to a considerable extent on some of the older properties. The shipping mines which are now operating have not worked continuously during the year; prospecting, as usual, has been steadily followed, with promising results. Upon inspecting these mines they have at all times been found in a safe condition.

Ainsworth District.

The mines of this district have operated intermittently during the year owing to shortage of water-supply during the cold weather; also the shortage of labour has had a depressing effect during the whole of the year. At the present time most of the shipping mines are operating with reduced crews. I have always found these mines in a safe and sanitary condition.

Slocan District.

There has been considerable increase in mining and developing. The same trouble existed here as in some other districts—namely, shortage of water and labour; but even with those drawbacks there has been considerable increase in many ways. Great energy has been displayed in opening up old properties and rushing development. Systematic development in opening up new ore-bodies has been successfully carried on in many of the older mines which have been operated for years. From my own inspections and from the reports of H. H. Johnstone, Inspector of Mines, special care has been exercised in handling explosives and otherwise caring for the safety and sanitary conditions.

Lardeau District.

There has not been any increase in mining in this district. During the year a number of small shipments have been made from time to time from many parts of this large district, with encouraging results. During the summer season prospecting and development was active. From the reports of H. H. Johnstone, Inspector of Mines, who made several inspections of the mines in operation, they were found to be well equipped, safe, and sanitary.

Boundary District.

The mines of this district have operated continuously during the year with a decreasing output compared to previous years. One of the larger shippers, the *Mother Lode* mine, near Greenwood, ceased operating on November 25th, 1918; the smelter which treated the output also closed about that time. Some of the smaller mines under lease have been operated with good results, although the number of workmen employed in them is small. Considerable development-work has been accomplished in the larger mines; also diamond-drilling has been actively carried on in an endeavour to locate new ore-bodies.

The large quantities of explosives which are necessary to operate the mines in this district have been carefully thawed and transported to the mines; also carefully handled underground when blasting, as the accident list does not show any cases where an accident occurred from explosions of powder. Upon inspecting these mines I have always found the requirements of the "Metalliferous Mines Inspection Act" conformed with.

YALE DISTRICT.

For the first half of the year mining in this district was active. Owing to lack of milling and transportation facilities one of the larger mines had to temporarily close. There is every indication that the coming year will see some large mines operating in this district. The older shipping mines have been successfully operated during the whole year. I have always found, upon inspections made during the year, care being taken and an honest endeavour to comply with the "Metalliferous Mines Inspection Act."

ROSSLAND DISTRICT.

The principal mining done during the year in this district has consisted of development-work, of which a great deal has been accomplished in the different mines. Although quite a force has been employed at that work, it would not amount to nearly half of the usual number generally employed when these mines are shipping steadily.

The same care has been exercised as formerly in keeping the large hoisting machinery, shaft, and guides in safe condition. The many miles of travelling-ways have also been kept in good condition, and the workings generally have been on all occasions when inspected found to be as safe as unavoidable conditions would allow.

I have always found an effort made by the management to operate these mines in compliance with the "Metalliferous Mines Inspection Act." Enclosed please find a list of the accidents which occurred in and around the mines during the year 1918.

EAST KOOTENAY INSPECTION DISTRICT.

REPORT OF ROBERT STRACHAN, INSPECTOR.

I have the honour to submit the annual report as Inspector of Metalliferous Mines for the East Kootenay District during the year ending December 31st, 1918.

The mines operating were the *Sullivan*, at Kimberley, and the *Lakeshore* and *St. Eugene*, at Moyie. Conditions around these mines are much the same as in 1917, work being retarded at the *Sullivan* owing to scarcity of workmen.

The extraction of ore proceeded fairly well at the *Sullivan*, but the development in the new tunnel was shut down twice during the year. Conditions around the mine are fairly good, care being taken to either secure or bar down all the loose pieces of rock, and where timbering is resorted to this was very well maintained. Ventilation in the upper working is by natural ventilation assisted by compressed air, and was fairly good; in the new tunnel a small power-driven fan produces ventilation.

So far as I could observe, the "Metalliferous Mines Inspection Act" is very well complied with, and a safety committee makes an inspection once every month, creating a better co-operation between the workmen and the officials in maintaining the safety of the mine. This committee, which is composed of officials and representatives appointed by the workmen, has resulted in maintaining a condition around this mine that we have not had a single accident report during the year, reflecting great credit on all the parties concerned.

Four samples of mine-air were taken in this mine during the year, and the resultant analyses showed conditions to be fairly good, not more than a trace of carbon monoxide showing. Detail sheets of these have already been sent you. The officials at the *Sullivan* are H. C. Montgomery, superintendent; J. Lindsay, mine foreman.

At the *St. Eugene* and *Lakeshore* mines the work consists of recovering ore which could not have been very successfully mined with machines; there is no machinery, all the work being accomplished by hand-steel. The ore is sorted inside the mine, sacked and trammed outside, and is teamed down the hill to the railway for shipment to the smelter.

In the *Lakeshore* part the work is under the charge of L. Horne, and I have generally found the conditions very good, places well timbered, and the Act well complied with.

At the *St. Eugene* only a very few men were employed during the year under John Taylor. The conditions here were very good, so far as safety was concerned, and the Act well complied with. The explosive generally used is Polar Ammonia Dynamite, and at each place is kept in a well-protected magazine, only such quantities taken out as were required for blasting purposes.

Like the *Sullivan* mine, no accidents have been reported during the year, which in itself reflects great credit on both the officials and workmen at these mines.

COAST INSPECTION DISTRICT.

Report of John Newton, Inspector.

I have the honour to submit my annual report of the metalliferous mines in my inspectorate for the year ending December 31st, 1918.

Britannia.

J. W. D. Moodie, general manager; E. J. Donohue, secretary-treasurer; E. P. Browning, general superintendent. The *Britannia* mine, the property of the Britannia Mining and Smelting Company, is situated on Howe sound, about twenty-eight miles from the city of Vancouver, and is reached by a daily steamship service. During the year a large amount of development-work has been done in this mine, as the following tabulation shows:—

	Feet.
Drifts	9,837
Crosscuts	4,427
Raises	8,754
Chutes	1,541
Winzes	36
Total	24,595

The *Fairview* mine drifts have been extended on previously developed veins; also new ones have been opened up to the south, on which stoping operations have started. The outside glory-holes were worked during the open season (seven months), breaking ore on top of the mountain into large transfer rock-chutes, delivering it to the underground crushers with but one handling.

The *Bluff* mine to the west and the *Empress* mine to the east of the *Fairview* have been extensively developed during the year and stoping has been started. Two drifts are being driven west under the *Jane* mine on the 1,200-foot level, developing this ore-body 200 feet below any previous working-level.

During the year another connection through Britannia mountain was made, this being on the 600-foot level, making the fourth level to have portals on both the north and south side of the mountain. Two other levels, the 1,200- and 1,600-foot, are being driven through for connection, the former having approximately 1,600 feet to go and the latter 700 feet.

Work is progressing for the extension of No. 1 shaft from the 1,000-foot level to the 700-foot level, and also the extension of the Grandview shaft (No. 3 shaft) from the 500- to the 700-foot level. This construction will in time supplement the No. 2 shaft, now operating between the 1,000- and 500-foot levels.

A crosscut adit, 8 x 8 feet, known as the Victoria tunnel, to the east of the present *Empress* workings at the elevation of the 1,800-foot level, has been advanced 400 feet, prospecting the extension of the veins in that section of the property.

Another crosscut, 8 x 8 feet, known as the Hillside tunnel, is being driven at a point west of the present *Jane* mine at the elevation of the 1,000-foot level. This has advanced approximately 200 feet.

Considerable diamond-drilling has been done during the year, prospecting new areas and also to prove the extension of known ore-bodies. The footages driven in the different mines are as follows:—

	Feet.
Fairview mine	15,062
Empress mine	4,897
Bluff mine	2,404
Jane mine	2,071
3,100-foot tunnel	690
2,700-foot tunnel	1,558
Total	26,682

The 4,100-foot level tunnel was advanced 1,735 feet during the year, making the total length 4,220 feet. A raise has been started at this level and driven a distance of 100 feet. This raise will be continued to the 3,100-foot level, a distance of 1,130 feet, and from there to the 2,700-foot level, 370 feet. This raise is 7 x 12 feet and is being driven on a 65 degree slope.

The 3,100-foot level east drift was advanced 659 feet, and from this drift another drift 260 feet long has been driven to the location of the proposed raise from the 4,100-foot level, from which point it is proposed to raise to the Armour crosscut, 2,700-foot level, at the westerly end of the tunnel railway. The Armour crosscut has been driven a distance of 502 feet.

The raise from the 4,100-foot level to the 2,700-foot level will be used to transfer the mine ore to the 4,100-foot level, and thence a distance of about 5,000 feet by railway to the mill.

The 2,200-foot Daisy tunnel was advanced 910 feet, making the total length 1,309 feet, and a crosscut 106 feet long driven to the south.

The Harp tunnel was advanced 811 feet to completion during the year. This tunnel is 2,246 feet long and will be used to divert water for power purposes.

The following tunnels driven for development-work were advanced during the year:—Lantz tunnel: Advance for year, 60 feet; footage to date, 890 feet. Lloyd tunnel: Advance for year, 71 feet; footage to date, 134 feet. Copper Mountain tunnel: Advance for year, 152 feet; footage to date, 324 feet.

Equipment.—Four Westinghouse 3½-ton storage-battery mine locomotives were added to the previous equipment of eight, in addition to which there are in the mine one 6-ton General Electric trolly locomotive and two 3½-ton Westinghouse trolly locomotives.

Fifty-four 2-ton automatic side-dump cars were added to the mine equipment, making a total of approximately 150 cars of this type. Besides these, twenty cars of the same type and size, but built for a 3-foot gauge, were added to the equipment for handling ore broken on the 2,200-foot level and for outside tunnels having 3-foot gauge.

The present equipment of the tunnel railway consists of two 20-ton bottom-dump cars, twelve 20-ton side-dump cars, two flat cars, four 15-ton electric locomotives, one 8-ton electric locomotive, and one 40-ton electric locomotive. The 40-ton locomotive was added during the year.

The present equipment of machine-drill sharpeners, including those located at outside tunnels as well as at the mine proper, consists of nine Leyner machines, four Sullivan, and one Waugh. A 3,600-cubic-foot-per-minute compressor, driven by a 600-horse-power output motor, was installed in the Beach power-house.

No new buildings were erected at the mine, with the exception of a concrete storage or root house; outside dimensions 38 x 30 feet, with an inside height of 9 feet at the crown of the arched roof. This is located at the tunnel cook-house and affords an excellent place for the storage of winter vegetables.

On my last examination I found the mine well ventilated and in a safe condition.

Marble Bay. This mine is situated on Texada island and is operated by the Tacoma Steel Company, with E. F. Eastman as managing director and D. C. Stephens as general superintendent. The mine has been developed down to the 1,600-foot level. A winze was driven down from the 1,500-foot level to the 1,600-foot level, with very good results. During the year two new 84-horse-power return-tubular boilers have been installed with mechanical stokers. The machinery installed is the same as in my previous report. When I last examined the mine I found it well ventilated and in a safe condition.

Retriever Group. This group is situated on the west side of the island, with Mr. Lee in charge. A small concentrator and ore-bunkers have been installed at the beach, connected to the mine by an incline about 1,200 feet in length. When I visited the mine I found the same in a safe condition; ventilation good.

Loyal. This mine is situated about three miles and a half north-east of Vananda. The company has unwatered the mine ready for operations in the near future.

Clayburn. This mine is operated by the Clayburn Company, of Clayburn, B.C. The mine it situated about four miles and a half from Clayburn and is reached by an electric tram-line. When I visited the mine I found it in a very safe condition; ventilation good.

NORTHERN INSPECTION DISTRICT.

Report of J. H. McMillan, Inspector.

I have the honour to present my annual report as Inspector of Coal and Metalliferous Mines for the Northern Inspection District for the year 1918.

The mineral production of the aforementioned district has been quite up to that of former years, notwithstanding a marked scarcity of labour and other incidental conditions. The production of the Omineca Division suffered considerably through the closing-down of the *Rocher Déboulé* mine, which up to the present time was the largest producer of the district.

This district has also temporarily lost the production of the *Silver Standard* mine, which, owing to the excessive freight charges on concentrates shipped to the United States, has closed down for the winter months. This mine, however, has considerable ore reserves, and will be reopened just as soon as conditions will permit of the mine being operated profitably. The outlook in the Portland Canal and Alice Arm districts is very bright, and the incoming year should see considerable mining activity in each of these districts.

Coal is now being shipped from the Telkwa River coalfield, and is supplying points along the Grand Trunk Pacific Railway, also the city of Prince Rupert, with a good grade of coal. The mine as yet is only in the first stages of development, and while the field is more or less faulted and broken up, there is sufficient coal available to meet the requirements of this northern country for a number of years.

The following is a list of the producing mines coming under my jurisdiction, together with a brief review of the prevailing conditions in each case:—

Observatory Inlet.

Granby Consolidated Mining, Smelting, and Power Co., Ltd.

Hidden Creek.

The general conditions prevailing at this mine are satisfactory and in full accord with the requirements of the "Metalliferous Mines Inspection Act" and amending Acts. Considering the large tonnage produced at this mine, the nature of the operations, and the class of labour available during the year, the number of fatal and major accidents at this mine have been comparatively small. First-aid and safety-first work have been kept up during the year, the company paying the employees taking part in the meetings full time while they are so engaged. The results of the first-aid and safety-first work at this mine, while comparatively good, could be improved if the miners and other labourers in the mine would follow up the instructions given them more closely, and apply them to their respective duties while at work.

The groundwork, however, is firmly set, and as soon as conditions become normal and the working force more permanent, the results will more than justify the interest taken in the movement by the local management. During the year I have received every assistance from those in charge of the underground work in the prevention of accidents, and any suggestions made by me during the year have been given immediate consideration by the management.

The ventilation of the mine has been considerably improved during the year by further connections having been made with the 385-foot level and the upper workings. The 150-foot level, which is the lowest level now being developed, has been extended to a distance of 2,700 feet. About 100 feet from the face of this tunnel, and a short distance to the right, a station has been cut out and a shaft driven upwards and connected with the 385-foot level. This shaft is 6 x 22½ feet in the clear and is divided into four compartments, two of which will be used for hoisting ore and the other two used as a manway and for hoisting or lowering supplies. The shaft is timbered with 12 x 12 timbers dipped in creosote; the sets are at 5 feet centres and lined close with 2 x 12 plank.

Two new drifts are being extended on this level into the ore-bodies, which continue to maintain a uniform grade. All ore mined on the 150-foot levels will be hoisted to the 385-foot level through the new shaft. The connection made by this shaft has not only improved the ventilation on the 150-foot level, but has also simplified the ventilation of the upper levels.

Samples of the mine-air were collected by me during the year at various points throughout this mine, and an analysis of these shows the atmosphere of the mine to be comparatively free from injurious gases. Sanitary conditions in and around the mine are all that could be desired.

Quartz Point. The conditions at this mine have been entirely satisfactory during the year, no accidents of a serious nature having occurred. During the year I collected several samples of the mine-air at this mine, and in each case these show the ventilation to be exceptionally good. The sanitary conditions in and around the mine are well loked after and the general requirements of the "Metalliferous Mines Inspection Act" strictly observed. During my several visits to this mine I have always found the daily reports of the mine-workings and machinery in order and entered up to date.

Macy. The general conditions at this property are very good and in full accord with the requirements of the "Metalliferous Mines Inspection Act." The daily examination of the mine-workings, ropes, and machinery is carefully attended to and the reports of same duly entered to date. Samples of the mine-air were taken by me during the year, the analysis of which shows the ventilation of the mine to be excellent.

Swamp Point. Conditions at this mine are quite satisfactory and the general requirements of the "Metalliferous Mines Inspection Act" strictly observed. Being an open-cut, the ventilation is always good. Sanitary conditions at the camp are excellent.

Dolly Varden. The underground workings at this mine were not extended any during the year. Operations were centred chiefly on the railway leading from tide-water to the mine, a distance of eighteen miles. The railway is now completed, but owing to some financial tangle the further development of the mine is not being proceeded with. The mine and, I might say, the whole district has great possibilities, and as soon as the present financial condition of the company improves we can expect considerable development.

Omineca Division.

Rocher Deboule. This mine was temporarily closed down early in October. Development-work on the lower levels failed to locate a continuation of the higher-grade ore found on the upper levels, and for the present further prospecting has been discontinued. There is still a considerable tonnage of milling-ore left in the mine and dumps, and it is quite possible that as soon as conditions become more favourable a small flotation plant will be installed to treat this ore. During the period of operation the general conditions at this mine were at all times excellent, and strictly in accord with the requirements of the "Metalliferous Mines Inspection Act."

Silver Standard. This mine operated more or less steadily up until December, when the management decided to temporarily cease operating on account of the present high transportation rates and other abnormal conditions which make mining in this particular case practically unprofitable. The general conditions throughout this mine are very good and at all times in strict accord with the requirements of the "Metalliferous Mines Inspection Act."

Hazelton View. This mine, which is situated on the north side of Rocher Déboulé mountain, operated more or less steadily during the year. The main tunnel was extended for a short distance and some stoping done. Some work has also been done on a copper-showing west of the No. 1 tunnel. The general conditions in and around this mine are in full accord with the requirements of the "Metalliferous Mines Inspection Act."

Golden Wonder. This mine is situated at the base of the north side of the Rocher Déboulé mountain and operated only for a few months during the year. The workings were not extended for any considerable distance during the period of operation and nothing further of importance can be reported. The conditions at all times were satisfactory and in accord with the requirements of the "Metalliferous Mines Inspection Act."

Telkwa Collieries, Ltd. This company is opening up a 6-foot seam of coal on Mud creek, a tributary of the Telkwa river, and to date has shipped approximately 500 tons. The coal finds a ready market along the line of the Grand Trunk Pacific Railway, also at Prince Rupert, and appears to be an excellent steam-fuel. A tunnel has been driven in on the strike of the seam for a distance of 200 feet. Several stalls have also been turned off and connected with an air-shaft to the rise of the tunnel. The mine is in as good condition as could be expected, and the ventilation for the present quite sufficient. So far no gas has been detected. Suitable buildings have been installed at the mine to accommodate twenty men.

Coast District.

Drum Lummon. This mine, which is situated near the head of Douglas channel, has been further developed during the year, and at the time of my visiting the property looked quite promising. The general conditions are satisfactory and the requirements of the "Metalliferous Mines Inspection Act" fully observed.

Surf Inlet. This mine has operated steadily throughout the entire year with marked success. The general condition of the underground workings has improved greatly as compared with previous years, and present an excellent example of how results can be obtained where efficiency and safety work together. The mine generally is in splendid shape and the ore-bodies on the lower levels show up very well, both with regard to width and values. The underground workings, ropes, and machinery are examined daily by competent men and the reports kept entered up to date. The sanitary conditions in and around the mine are well looked after and the general requirements of the "Metalliferous Mines Inspection Act" fully observed. During the year I collected several samples of the mine-air at this mine, and in each case the analysis shows that the ventilation is comparatively free from injurious gases.

Pugsley. This mine is situated a little south of and on the same mineralized zone as the Surf Inlet mine. The main tunnel is now in over 900 feet, and at the time of my last visit was following a 2-foot vein carrying considerable copper and gold sulphides. The general conditions at this property are satisfactory and in accord with the "Metalliferous Mines Inspection Act."

Atlin Division.

Engineer. This mine, which is situated on the southern end of Tagishe lake, was operated for a few months during the summer. The general conditions in and around the mine are fair and the requirements of the "Metalliferous Mines Inspection Act" observed.

Placer-gold Mining.

While in the Atlin district I visited the majority of the placer mines now being operated on the creeks adjacent to the town of Atlin. On several of the creeks the gold is recovered by drifting methods. The method of mining is somewhat similar to the pillar-and-stall method of mining coal. The original river-channels on which the pay-dirt is found are from 20 to 50 feet vertically below the present creek-beds. Inclined drifts, and in some cases vertical shafts, are driven down to bed-rock, and from these drifts prospect-drifts are driven in various directions until the original channel containing the gold is located. This pay-streak varies in width from a few feet to 100 or more, and when located is blocked out into pillars which are later extracted and the overlying gravel allowed to cave behind. The narrow work or drifts, as they are termed, run from 8 to 15 feet in width, according to the overhead pressure, and are closely timbered by sets which are lagged tight on the top and sides. The workings of some of the mines are in over 1,500 feet from the bottom of the shaft or incline, as the case might be, and have only single openings. The overlying gravel, which runs from 80 to several hundred feet in thickness, is very strong and cohesive, and invariably the gravel immediately overlying bed-rock has to be blasted.

The general conditions prevailing at these mines cannot be termed either safe or sanitary. The miners, however, are a very competent class of men, and this without doubt accounts for the absence of serious accidents. The mines are very wet, and at several while making my examination I was compelled to walk up to the knees in running water, which percolates through the gravel from one mine to another. The latter condition to my mind is not safe by any means, more particularly where a mine is operating in ground adjacent to other mines that are filled with water and abandoned. The mines, with one or two exceptions, are operated by individual miners, and while some are making fair recoveries, others are not, and to place these mines under the jurisdiction of the "Metalliferous Mines Inspection Act" would work a hardship and eventually put the individual miner out of business. I would, however, suggest that special rules be adopted covering the placer mines of this district, more particularly drifting operations, touching chiefly on timbering, ventilation, and the maintenance of second openings.

LIST OF ACCIDENTS IN METALLIFEROUS MINES, 1918.

COAST DISTRICT.

REPORT OF J. H. McMILLAN AND JOHN NEWTON, INSPECTORS.

No.	Mine.	Date.	Name.	Occupation.	Details.
1	Hidden Creek, Anyox..	Jan. 31	John Holm....	Miner	Tripod weight fell on his foot, breaking bone in left foot.
2	Swamp Point.....	Feb. 22	Joe Maladoze..	Miner	Rock fell down face of quarry and struck left arm, breaking it between shoulder and elbow.
3	Hidden Creek, Anyox..	Feb. 24	A. Flore.....	Mucker-boss.	Crushed chest, lacerated scalp, compound fracture of nose; lost footing and slid down slope.
4	" " ..	Mar. 7	L. Comandini .	Chuteman...	Depressed fracture of skull, right side, cerebral hæmorrhage, caused by being struck by bar.
5	" " ..	Mar. 9	A. D. Wooler .	Mucker.....	Struck by rock, crushed pelvis, left leg, and left chest, with possible fracture of two former.
6	" " ..	Mar. 27	James Regan .	Miner	Struck by rock, which cut front of head and broke big toe of right foot.
7	" " ..	Apr. 12	Nick Macenko.	Mucker.....	Rock hit right hand and pinched off third finger.
8	" " ..	Apr. 16	G. Cossarin ...	Loader's [helper	Slipped and twisted left ankle and tip of small bone was broken off.
9	" " ..	Apr. 26	Aime Rennie..	Barman.....	Crushed to death by fall of rock.
10	" " ..	May 2	Eli Utivich....	Chuteman...	Muck crushed skull and badly bruised body, which proved fatal.
11	" " ..	May 6	Pete Valison ..	Chuteman...	Struck by muck, which crushed right ankle; both bones broken.
12	" " ..	May 14	John Larson...	Chuteman...	Hand pinched between bar and chute-gate, breaking fifth metacarpal in right hand.
13	" " ..	May 14	G. W. Suther- [land	Miner	Crushed right hand, index finger broken, and end of thumb crushed between two rocks.
14	" " ..	May 23	Geo. Drezgich .	Nipper	Fell and fractured skull.
15	" " ..	Sept. 15	Alex. Giyenic .	Mucker.....	Wheel of car passed over hand, crushed it, and broke some bones.
16	" " ..	Oct. 9	A. Martinson..	Steel- [sharpener	Machine caught his right hand and cut off thumb.
17	Surf Inlet.....	Oct. 18	J. Post	Miner	Fatally injured by fall of rock in stope.
18	Hidden Creek, Anyox..	Oct. 19	J. MacDonald.	Miner	Using air-drill and rock fell, causing him to fall down slope; broke left collar-bone and ankle.
19	Hidden Creek, Anyox..	Dec. 30	Eric Anderson.	Barman.....	Rock struck bar which broke his left forearm.

KOOTENAY-SIMILKAMEEN DISTRICT.

REPORT OF JAMES McGREGOR AND H. E. JOHNSON, INSPECTORS.

20	Granby, Phoenix	Jan. 2	N. Davidson..	Shiftboss....	Caught right hand in electric shovel, crushing it.
21	Emma, Coltern.....	Jan. 3	James Cairns..	Miner	Cap exploded and blew off thumb, first and second finger at second joint.
22	Rambler, Slocan.....	Jan. 14	H. Sjoholm ...	Miner fore- [man	Cage dropped and his left knee-cap was broken.
23	Bluebell, Ainsworth. ..	Feb. 7	Jack Olufson ..	Miner	Loose pipe crushed his right hand.
24	Granby, Phoenix	Feb. 17	Dan Voinovich.	Chuteman...	Broken and crushed left arm, caused by being struck by muck.
25	Nickel Plate, Hedley...	Feb. 17	Chas. Berto ...	Mucker.....	Jammed between car and wall, right leg was broken between knee and ankle.
26	Florence, Ainsworth ...	Mar. 25	Chas. Ostrom..	Miner	Buried under muck; proved fatal.

KOOTENAY-SIMILKAMEEN DISTRICT—*Concluded.*

No.	Mine.	Date.	Name.	Occupation.	Details.
27	Copper Mtn., Princeton	July 3	V. A. Price....	Hoistman...	Struck on head by small rock, which crushed his skull and caused instant death.
28	Granby, Phoenix	July 19	T. Roderick...	Timberman..	Caught between car and side of drift, which crushed his chest.
29	Rambler-Cariboo	Aug. 5	T. McVeight..	Driver	Right leg broken, caused by car he was dumping turning over on him.
30	Mother Lode, Greenwood	Aug. 10	M. Plecash.... [rovich	Barman.....	Right shoulder-blade and pelvis-bone fractured, intestines torn, caused by fall of rock.
31	Mother Lode, Greenwood	Aug. 18	S. Vukoni-	Miner	Instantly killed by falling rock.
32	Eastmont, Slocan	Oct. 18	J. T. Beau- [chesne	Miner	Broken back, terminating in death, caused by fall of rock from roof.
33	Le Roi No. 2, Rossland.	Nov. 30	A. Nyberg....	Contractor- [machineman	Injuries around upper part of thigh on left leg, caused by car forced upwards through cage.
34	Le Roi No. 2, Rossland.	Nov. 30	J. X. Hendric- [son	Contractor- [machineman	Injuries in lower part of body, caused by car forced upwards through cage.
35	Le Roi, Rossland.....	Dec. 20	Fred Graham..	Shiftboss ...	Killed by air-blast.

COAL-MINING IN BRITISH COLUMBIA.

By Wm. Fleet Robertson, Provincial Mineralogist.

During the year 1918 there was mined in the various collieries of the Province 2,578,724 tons (2,240 lb.) of coal, an increase over the preceding year of 180,009 tons, equivalent to nearly 7.5 per cent.

That the total output of the Province is greater this year is attributable to increases in the Crowsnest District of 181,113 tons and in the Nicola District of 27,936 tons, which more than offset a decrease of 29,510 tons in the Vancouver Island collieries.

In addition to this, the output of coke shows an increase of about 18 per cent. as compared with the previous year.

The following table shows, for the past ten years, the output and the *per capita* production of the various districts:—

Output and Per Capita Production of Various Districts.

Year.	District.	Gross Tons of Coal mined during Year.	Total No. of Employees at Producing Collieries.	Tons of Coal mined per Employee for Year.	Number of Men employed Underground in Producing Collieries.	Tons of Coal mined per Underground Employee for Year.
1909	East Kootenay District	923,865	2,427	380	1,737	532
	Coast District	1,476,735	3,991	370	2,976	496
	Whole Province	2,400,600	6,418	374	4,713	509
1910	East Kootenay District	1,365,119	3,111	439	2,374	575
	Coast District	1,774,116	4,647	382	3,529	502
	Whole Province	3,139,235	7,758	404	5,903	532
1911	East Kootenay District	442,057	2,197	201	1,585	272
	Coast District	1,855,661	4,676	397	3,627	511
	Whole Province	2,297,718	6,873	334	5,212	440
1912	East Kootenay District	1,261,212	2,410	523	1,780	708
	Coast District	1,764,497	4,720	374	3,495	504
	Whole Province	3,025,709	7,130	424	5,275	574
1913	East Kootenay District	1,331,725	2,666	500	1,965	678
	Coast District	1,239,035	3,777	328	2,865	433
	Whole Province	2,570,760	6,443	399	4,830	532
1914	East Kootenay District	955,183	2,397	399	1,749	547
	Coast District	1,211,245	3,335	363	2,518	481
	Whole Province	2,166,428	5,732	379	4,267	508
1915	East Kootenay District	852,572	1,748	488	1,183	721
	Coast District	1,120,008	3,230	347	2,512	446
	Whole Province	1,972,580	4,978	396	3,695	534
1916	East Kootenay District	882,270	1,674	527	1,125	784
	Coast District	1,603,310	3,386	474	2,569	624
	Whole Province	2,485,580	5,060	491	3,694	673
1917	East Kootenay District	551,751	1,481	372	944	584
	Coast District	1,846,964	3,689	501	2,816	656
	Whole Province	2,398,715	5,170	463	3,760	638
1918	East Kootenay District	732,864	1,327	552	814	900
	Coast District	1,845,860	4,100	450	2,844	645
	Whole Province	2,578,724	5,427	475	3,658	705

While no figures can be given as to the actual cost of mining in the different fields, the *per capita* production of these fields is of interest, as having a bearing upon the working costs and as indicating the mining facilities existing and the improvement made in these conditions from year to year.

It will be seen from the foregoing table that the production *per capita* increased more or less regularly up to the year 1912, but that the years 1913, 1914, and 1915 show a decrease, especially in the Coast District. This decreased effectiveness, during the last few years, of the labour employed is largely due to the extension of the workings of the mines, causing a greater length of haulage and greater extent of old workings to be taken care of, but some of the increased labour is undoubtedly on account of the greater number of men employed in safe-guarding the mine and workmen. In the year 1917 it will be observed that while the *per capita* output of the Coast collieries also shows an increase, the Crowsnest District shows a very considerable decrease, which is caused by the fact that a large amount of the underground labour in these collieries is engaged in non-productive work, such as repairing the damage from the former explosion and in opening up a new system of mining which it is expected will tend to greater safety of employees and also of the property.

In 1918 in the Coast District the production *per capita* of men employed underground has decreased from 656 tons to 645 tons; while in the Crowsnest District such production *per capita* has increased phenomenally, from 584 tons to 900 tons, the highest it has ever been, which raises the *per capita* for the whole Province to 705 tons, the highest it has ever been.

Owing to war conditions the operation of all the collieries in the Crowsnest field, in Alberta and British Columbia, has been placed under the control of a Commissioner—W. H. Armstrong—appointed by the Federal Government.

The market of the East Kootenay field is provided primarily by the railways of the south-eastern part of the Province and of the northern parts of the adjoining States of Montana and Washington, approximately three-quarters of the coal, sold as such, being exported to those States, while the remainder went to supply the demands of the south-eastern part of the Province—its domestic needs, its railways, steamboats, mines, and smelters. The competition of fuel-oil, frequently referred to in the past, has diminished and promises to practically cease, as supply of oil is scarcely attainable now, and even then only at a price which is not competitive with coal.

Coke, a product of the coal-mines, is sold in the same markets, with the difference that the local consumption—chiefly by the smelters of Trail and the Boundary District—took about 90 per cent. of the product, while 10 per cent. was exported to the States mentioned.

As regards the marketing conditions in this field, the East Kootenay collieries are, however, brought into direct competition with the collieries of Alberta, just over the Provincial boundary-line, all these collieries being in the same coalfield, with practically the same grade of coal and working under similar conditions.

The Coast District may be subdivided into two fields—the Nicola-Princeton field and the Vancouver Island field—in which the markets differ considerably.

During the past year a new coalfield on the Telkwa river, in Omineca Division, has been opened up, and produced some 470 tons of coal which was sold locally. The production of this field has been included in the Coast District.

In the Nicola-Princeton field the consumption is chiefly by the local railways, while a small amount finds its way to Vancouver, even under the handicap of what seems to be an excessively high freight charge.

The Vancouver Island coal market is provided by the domestic and manufacturing requirements of the Coast cities, and of the ocean-going steamers calling at these ports.

The larger coasting steamers and railways, which in later years have all been using California crude oil as fuel, will now be forced to come back to the use of coal, which will mean a largely increased production from Coast collieries.

As in former years, the greater proportion of the coal production was made by three larger companies—the Crow's Nest Pass Coal Company, with two collieries in East Kootenay; and by the Canadian Western Fuel Company, of Nanaimo, and the Canadian Collieries (Dunsmuir), Limited (formerly the Wellington Colliery Company), these last two operating on Vancouver island.

In addition to these large collieries, shipments have been made by the Corbin Coal and Coke Company, in East Kootenay; by the Middlesboro Collieries, Fleming Coal Company (operated

Coal Hill Colliery), and Coalmont Collieries, Limited, all of the Nicola Valley; by the Princeton Coal and Land Company, of Princeton; by the Pacific Coast Coal Mines, Limited, British Columbia Coal Mining Company, Limited (formerly Vancouver & Nanaimo Coal Mining Company), and Nanoose Collieries, Limited, all operating on Vancouver island, near Nanaimo; and by Granby Colliery No. 1 at Cassidy, and Telkwa Collieries Company, of Telkwa.

The details of the shipments made by each of these companies will be found in reports of the Inspectors of the various districts.

During the year 1918 about 60 per cent. of the coal, sold as such by the collieries of the Province, was consumed in British Columbia; and the remainder was exported to the United States, including Alaska. Of the coke sold, about 90 per cent. was consumed in British Columbia, and the remaining 10 per cent. was exported to the United States.

The distribution of this output of coal and coke is shown in the following table:—

COAL AND COKE PRODUCED, EXPORTED, ETC., BY PROVINCE DURING YEAR 1918.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	1,010,938		172,276	
" export to United States	752,821		17,404	
" " other countries	58,417			
Total sales		1,822,176		189,680
Lost in washing	238,469			
Used in making coke	276,479			
" under colliery boilers, etc.	200,698		115	
Total for colliery use		715,646		115
		2,537,822		189,795
Stocks on hand first of year	34,110		2,947	
" last of year	75,012		2,119	
Difference {added to* / taken from†} stock during year		*40,902		†828
Output of collieries for year		2,578,724		188,967

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	200		126		326	
Whites—Miners	1,494				1,494	
Miners' helpers	126				126	
Labourers	703		479		1,182	
Mechanics and skilled labour	523		557		1,080	
Boys	77		92		169	
Japanese—Miners	58				58	
Helpers	26				26	
Labourers	13		2		15	
Chinese—Miners	94				94	
Helpers	124				124	
Labourers	220		513		733	
Totals	3,658		1,769		5,427	

COLLIERIES OF THE COAST DISTRICT.

The gross output of the Coast District collieries, including the Nicola valley and Telkwa, for the year 1918 was 1,845,860 tons (of 2,240 lb.) of coal actually mined, while some 22,845 tons was added to "stock," making the actual consumption of coal 1,823,015 tons.

Of this gross consumption 1,402,316 tons was sold as coal, 142,058 tons was consumed by the producing companies as fuel, and 238,469 tons was lost in washing; while 40,172 tons was used in making coke.

Formerly, in 1902, the Coast collieries exported to the United States 75 per cent. of their coal; in 1910 they exported thereto only 24.5 per cent. of their product, 71.3 per cent. of the output being consumed in Canada. In 1911, 76.1 per cent. of the coal sold was for consumption in Canada, 21.6 per cent. was exported to the United States, and 2.3 per cent. to other countries.

In 1912, 71.25 per cent. was sold for consumption in Canada, 21.25 per cent. exported to the United States, and 7.47 per cent. to other countries.

In 1913, 89.8 per cent. was sold for consumption in Canada, and the balance, or 10.2 per cent., was exported to the United States.

In 1914, 77.3 per cent. was sold for consumption in Canada, and the balance, or 22.7 per cent., was exported to the United States.

In 1915, 67 per cent. was sold for consumption in Canada, and the balance, or 33 per cent., was exported to the United States.

In 1916, 63 per cent. was sold for consumption in Canada, and the balance, or 37 per cent., was exported to the United States.

In 1917, 60 per cent. was sold for consumption in Canada, 37 per cent. exported to the United States, and 3 per cent. to other countries; and in 1918 the proportions were almost the same.

The following table gives an aggregate summary of the output of the Coast collieries for the year 1918, and shows the disposition made of such product:—

RETURNS FROM THE CANADIAN COLLIERIES, LTD., MINES FOR YEAR 1917.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	933,296		24,501	
" export to United States	410,603			
" " other countries	58,417			
Total sales		1,402,316		24,501
Lost in washing	238,469			
Used in making coke	40,172			
Used under colliery boilers, etc	142,058		115	
Total for colliery use		420,699		115
		1,823,015		24,616
Stocks on hand first of year	34,046		1,473	
" last of year	56,891		1,744	
Difference added to stock during year		22,845		271
Output of collieries for year		1,845,860		24,887

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	155		99		254	
Whites—Miners	1,103				1,103	
Miners' helpers	126				126	
Labourers	585		180		765	
Mechanics and skilled labour	273		386		659	
Boys	67		76		143	
Japanese—Miners	58				58	
Helpers	26				26	
Labourers	13		2		15	
Chinese—Miners	94				94	
Helpers	124				124	
Labourers	220		513		733	
Totals	2,844		1,256		4,100	

The following tables show the output of coal and the disposition made of it in the subdivisions of the Coast District:—

COAL-OUTPUT, ETC., 1918, VANCOUVER ISLAND SUB-DISTRICT.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	782,147		24,501	
" export to United States	398,631			
" " other countries	58,417			
Total sales		1,239,195		24,501
Lost in washing	236,905			
Used in making coke	40,172			
" under colliery boilers, etc	128,191		115	
Total for colliery use		405,268		115
		1,644,463		24,616
Stocks on hand first of year	33,772		1,473	
" last of year	55,520		1,744	
Difference added to stock during year		21,748		271
Output of collieries for year		1,666,211		24,887

COAL-OUTPUT, ETC., 1918, NICOLA-PRINCETON SUB-DISTRICT.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	150,679			
" export to United States	11,972			
Total sales		162,651		
Lost in washing	1,564			
Used in making coke				
" under colliery boilers, etc	13,867			
Total for colliery use		15,431		
		178,082		
Stocks on hand first of year	274			
" last of year	1,371			
Difference added to stock during year		1,097		
Output of collieries for year		179,179		

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COLLIERIES OF THE EAST KOOTENAY DISTRICT.

The gross output of the collieries of the East Kootenay District for the year 1918 was 732,864 tons (2,240 lb.) of coal actually mined, while 18,057 tons was added to stock, making the actual consumption of coal 714,807 tons. Of this gross consumption of coal, 419,860 tons was sold as coal, 58,640 tons was consumed as fuel by the producing companies, while 236,307 tons was converted into coke, producing 164,080 tons of coke, while 1,099 tons was taken from stock, making the coke sales for the year 165,179 tons.

The East Kootenay collieries exported to the United States about 80 per cent. of the coal sold and about 10 per cent. of the coke.

The following table gives an aggregate summary of the output of the East Kootenay collieries for the year 1918 and shows the dispositions made of such product:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	77,642		147,775	
" export to United States	342,218		17,404	
" " other countries				
Total sales		419,860		165,179
Used in making coke	236,307			
" under colliery boilers, etc	58,640			
Total for colliery use		294,947		
		714,807		
Stocks on hand first of year	64		1,474	
" last of year	18,121		375	
Difference {*added to / †taken from} stock during year		*18,057		†1,099
Output of collieries for year		732,864		164,080

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	45		27		72	
Whites—Miners	391				391	
Miners' helpers						
Labourers	118		299		417	
Mechanics and skilled labour	250		171		421	
Boys	10		16		26	
Japanese						
Chinese						
Indians						
Totals	814		513		1,327	

INSPECTION OF COAL-MINES, 1918.

The coal-producing areas of the Province are divided into the Coast District, which includes the Vancouver Island and the Nicola-Princeton coalfields, and the East Kootenay District.

COAST DISTRICT.

This district, comprising, as it does, the coalfields of Vancouver island and the Coast, as well as those of the Nicola and Similkameen valleys, has been subdivided, for inspection purposes, into three Inspection Districts.

Two of these Inspection Districts are on Vancouver island, with headquarters for both at Nanaimo, which permits of one of the Inspectors being constantly at headquarters while the other is making inspections; it also permits of the interchanging of inspection duties, so that each Inspector knows both districts.

The third district is the Nicola-Princeton Inspection District, with headquarters at Merritt. During 1918 there was no Inspector for this district, but from January to May inspections were made by John Newton from the Nanaimo office; while from May to the end of the year the inspections were made by either Robert Strachan or Wm. Lancaster, Inspectors from the Fernie office.

NANAIMO INSPECTION DISTRICT.

JOHN NEWTON, INSPECTOR (OFFICE, NANAIMO).

The collieries operating and producing coal during the year in this Inspection District, including the new mines that have been started, were:—

NANAIMO: The Canadian Western Fuel Company—No. 1 shaft, Protection shaft, Reserve Colliery, Harewood mine, and two new shafts, called the Wakesiah shafts, which did not produce coal in 1918.

Pacific Coast Coal Mines, Limited—The Morden mine.

British Columbia Coal Mining Company, Limited—New East Wellington Colliery, Mountain District, Nanaimo, No. 1 slope.

Nanoose Collieries, Limited—No. 1 mine.

COMOX INSPECTION DISTRICT.

HENRY DEVLIN, INSPECTOR (OFFICE, NANAIMO).

The collieries operating and producing coal during the year in this Inspection District, including the new mines that have been started, were:—

EXTENSION: The Canadian Collieries (Dunsmuir), Limited—Nos. 1, 2, and 3 mines, all worked from what is known as the No. 1 tunnel, and No. 5 mine at South Wellington.

CUMBERLAND: The Canadian Collieries (Dunsmuir), Limited—Nos. 4 and 7 slopes and No. 5 shaft.

Granby Colliery No. 1 at Cassidy—3 slopes.

NICOLA-PRINCETON INSPECTION DISTRICT.

The collieries in this district were inspected during the year by Inspectors from the Nanaimo and Fernie offices.

The collieries operating during the year in this Inspection District, including the new mines that have been started, were:—

NICOLA VALLEY: The Middlesboro Colliery of the Middlesboro Collieries, Limited, Merritt—Nos. 2, 3, 4, 5, 6, and 7 mines.

Inland Coal and Coke Syndicate, Merritt—One shaft and 3 slopes.

Fleming Coal Company.

PRINCETON: Princeton Coal and Land Company's Princeton Colliery—No. 1 slope.

COALMONT: Columbia Coal and Coke Company, Limited—Developing only.

EAST KOOTENAY DISTRICT.

The East Kootenay District is subdivided into two Inspection Districts—i.e., Northern Inspection District and Southern Inspection District. Both these districts are inspected by Robert Strachan as Senior Inspector and Wm. Lancaster, Inspector with headquarters at the Mine-rescue Station at Fernie.

NANAIMO INSPECTION DISTRICT.

REPORT OF JOHN NEWTON, INSPECTOR.

I have the honour to submit my annual report for the year ending December 31st, 1918, on the various coal-mines in my inspectorate, consisting of the Canadian Western Fuel Company, Pacific Coast Coal Mines, Nanoose Collieries, and the British Columbia Collieries, all in the Nanaimo Inspectorate.

A short description is given of each colliery in the district, with names of certified officials.

RESCUE AND FIRST-AID WORK.

I am pleased to say that the interest in this work mentioned in my last report has been maintained. All the mines in the district have a number of fully efficient men and equipment ready for any emergency.

The Government station, with J. D. Stewart in charge, which is in a central position, is always ready to meet any demands that can be made upon it.

During the year samples of the mine-air have been taken in every mine, every split, and every return airway in my Inspectorate. Copies of same have been forwarded to your office in Victoria.

The Canadian Western Fuel Company.

Head Office—Nanaimo, B.C.

Capital, $1,500,000.

Officers.	*Address.*
G. W. Bowen, Vice-Chairman,	Nanaimo, B.C.
Mark Bate, Jr., Secretary-Treasurer,	Nanaimo, B.C.
John Hunt, General Superintendent,	Nanaimo, B.C.
T. R. Jackson, Mine Manager, No. 1 Mine,	Nanaimo, B.C.
James Dickenson, Mine Manager, Reserve Mine,	Nanaimo, B.C.
Richard Battey, Harewood Mine,	Nanaimo, B.C.

The above company has operated the following collieries at Nanaimo during the past year, namely: No. 1 or Esplanade shaft, Nanaimo; Protection Island mine, Harewood, and Reserve.

The following returns show the combined output of all the company's mines for the past year:—

AGGREGATE RETURNS FROM CANADIAN WESTERN FUEL COMPANY'S MINES FOR YEAR 1918.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	375,612			
" export to United States	193,480			
" " other countries	19,810			
Total sales		588,902		
Lost in washing	31,272			
Used under colliery boilers, etc.	76,463			
Total for colliery use		107,735		
		696,637		
Stocks on hand first of year	8,008			
" last of year	43,293			
Difference added to stock during year		35,285		
Output of collieries for year		731,922		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	36		29		65	
Whites—Miners	437				437	
Miners' helpers	9				9	
Labourers	262		48		310	
Mechanics and skilled labour	107		129		236	
Boys	50		43		93	
Japanese						
Chinese—Labourers			168		168	
Indians						
Totals	901		417		1,318	

No. 1 mine of the Canadian Western Fuel Company is situated at the south end of the Esplanade, in the city of Nanaimo, and has been in operation for many years, with good prospects for many years to come.

The present operations are at a depth of 600 to 1,000 feet below the surface, with a large submarine area. This shaft has three openings—namely, the No. 1 hoisting-shaft, Protection shaft, and Newcastle Island shaft. These shafts are all connected underground by good travelling-roads and are all equipped by hoisting apparatus in case of emergency.

The general operations of the mine as far as development-work is concerned are identical with my report of 1917, with the exception that the main South side slope, which has been standing for several years past, is now being cleaned up. It is the intention to develop this hitherto unworked area of ground as quickly as possible.

In the Long-wall slope information has been obtained by means of levels, etc., which will finally lead to driving a rock drift on a grade suitable for motor-haulage to tap the Newcastle seam of coal at a point on the north side of the present slope, and will be considerably lower than any working section engaged at present. This will increase the big machine run considerably, render a larger output, and greatly facilitate the haulage system.

During the year the company has introduced more Edison electric head-lamps, mostly to drivers, pushers, and timbermen, which greatly reduced the number of mine accidents. Open lights have been eliminated in all the mines, with the exception of the Nanoose Collieries and a few in and around the shaft-bottoms in the other mines, but within the near future all open lights will be abolished in all the mines in British Columbia.

Number of electric lamps in operation in the mine: Edison head-lamps, 450; Wico, 45; Ceag, 20.

In addition to all these improvements towards "safety first," the company has erected dust-zones in all intake and return airways; also two men constantly on night shift, watering and cleaning up all haulage-roads and working places. There is also a line of water-pipes all along the Main and Tail haulage-roads, with sprays at intervals—two at the foot of the Diagonal slope, one at foot of the Right incline, and two at the bull-wheel siding. A boy is stationed on an elevated platform at the outside end of this siding with a hose attached to the discharge-pump and sprays all loaded trips as they pass outside.

Mine-rescue Work.

Regarding this branch of work, I am pleased to say that some of the companies in my district, especially the Canadian Western Fuel Company, have taken up this branch of work, which reflects a great deal of credit to both managers and workmen alike.

In my report of last year I commented upon the work that this company was doing along the lines of "safety first" and "first-aid." It is a pleasure to report that the company is continuing this good work, with most gratifying results.

In addition to the active interest this company has displayed in promoting "first aid," it has purchased six new apparatus of the Gibbs type, and quite a number of workmen will avail themselves of the opportunity to take a course of training in mine-rescue work.

NEW WAKESIAH MINE.

W. Moore, Manager; J. A. Challoner, Mine Foreman; Geo. Carson, Fireboss.

This mine is situated on the Wakesiah Farm of the Canadian Western Fuel Company, about two miles from Nanaimo Post-office and immediately adjoining the British Columbia Mining Company's property. Railroad connection is made with the Harewood branch line.

Sinking was commenced on No. 2 shaft on June 17th, 1918. This shaft is 7 x 10 feet, finished, with 6- x 12-inch sawn timbers. Bed-rock was struck at 7 feet and at 85 feet; the conglomerate was reached when the shaft was stopped to allow concrete rings to be put in. Sinking was then commenced on No. 1 shaft, which is 150 feet from No. 2 shaft centres; this shaft is 9 x 18 feet, finished, timbered with 6- x 12-inch sawn timbers. The bottom of the conglomerate being reached at about 82 feet, it was decided to stop and concert to the surface. Sinking was recommenced on No. 2 shaft and continued until the Wellington seam was reached at 325 feet on September 19th. A small sump was made and drifting commenced. Sinking was again started on No. 1 shaft and continued without interruption (except for eight days' delay owing to shortage of water for boilers) until the Wellington seam was reached at 320 feet, when, after a small sump was made, drifting was begun to connect up with No. 2 shaft, and prospect-levels driven off north-west and south-east to ascertain the continuity of the pitch and strike.

In sinking through the conglomerate three Denver Dreadnaught drilling-machines were in operation and did good work, being replaced in the softer rocks with the Denver Clipper drilling-machine, which also gave good satisfaction. The shafts were each ventilated by a small Sirocco force-fan, 12 x 24 inches, running at 600 revolutions a minute, which supplied ample ventilation while sinking. The permanent fan to be installed will be a 90-inch Sirocco, rope-driven, with the usual housing, etc.

During the sinking of No. 1 shaft a pit-head was erected at No. 2 and a Parke & Lacey 10- x 15-inch engine, geared 5 to 1, having a 60-inch drum, was installed. The rope is a 6/19 1⅛-inch plough steel. Development is being carried on at No. 1 shaft with a Parke & Lacey 9- x 12-inch engine, geared 5 to 1, while the permanent engine is a 14- x 18-inch first-motion engine by the Sandycroft Foundry Company, of Chester, England. Steam is supplied by two 80-horse-power tubular boilers at 120 lb. pressure, with stacks 52 and 60 feet high. Power is supplied by two compressors—one by Canadian Rand Drill Company and one compound by Chicago Pneumatic Tool Company. Light is supplied by a small 7-kw. Curtis steam-turbine generator.

It is the intention of the management to drive levels in some distance, to be assured of the pitch and strike, before laying out a permanent shaft-bottom at No. 1 shaft. A small Cameron pump has been installed at both shafts. Development-work will be carried on from No. 2 shaft while No. 1 pit-head is being erected, which will shortly be proceeded with, and which will embody some absolutely new idea in safety of operation.

Both shafts have been sunk and whole operations so far carried on without a single serious accident, notwithstanding the fact that the shafts were sunk in record time, as much as 152 feet being sunk and timbered in a month. The top of the shaft was completely covered by a carriage operated by compressed air during the dumping of the buckets, making it impossible for materials to fall back in the shaft. Permanent extensions to railway sidings, new tipples, screens, and fans, with all the necessary equipment thereto, will be installed in the near future.

There is now on the ground office and store buildings, blacksmith and machine shop, in which is installed a No. 8 Waugh drill-sharpener among other features, and a carpenter-shop.

The one outstanding feature of the whole operation is the fact that, notwithstanding the many dangers incidental to shaft-sinking and construction-work in general, it has been possible to make such provision for the safety of the employees as to eliminate practically the serious dangers. For this the company should be congratulated, for it has spared neither trouble nor expense in carrying out its policy of "safety first."

NANAIMO COLLIERY.

Thomas R. Jackson, Manager.

No. 1 SHAFT, ESPLANADE.

David Brown, Overman of the North Side of the Mine; Robert Adam, William Neave, William Johnson, James McMeekin, William Holliday, Ernest Kelly, George Jardine, Robert Seggie, George Gray, James Brown, Alex. Parke, William Lindsey, Thomas Brace, George Perry, J. Sullivan, and George Stewart, Firemen.

The seams worked are the Douglas and Newcastle. The coal produced from the No. 1 North level is all from the Newcastle seam, which lies 70 feet below the Douglas, and is penetrated by three slopes—namely, Nos. 1, 2, and 3—varying from 4,000 to 5,000 feet between each slope, and covers an extensive working-face.

The seam varies from 3 to 3½ feet in thickness, is of a very hard nature, and is worked on the long-wall system, to which it is well adapted. Mining-machines of the "pick quick" (or bar machine) and puncher types, operated by compressed air, are used to undercut the coal, the cut varying from 5 to 6 feet in depth.

A large staff of officials is employed in these sections, as shotlighters, facemen, and timbermen, to look after the safety of the workmen engaged.

For every four loaders there is a certificated coal-miner engaged to break the coal down, and for every eight loaders there is one timberman employed and a certificated fireman, who is in charge of the section; in addition, notices are posted in all sections of the mine, warning workmen against the violation of the general and special rules.

During the year Chief Inspector of Mines Wilkinson approved of the Burrell gas-tester as a standard for the testing of marsh-gas in coal-mines of British Columbia.

I have taken tests with the above gas-tester in every split and every return airway in my Inspectorate, a record of which has been forwarded to the office in Victoria.

The ventilation of these sections is produced by a Guibal force-fan, 9 x 18 feet, and 100 horse-power, rope-driven, making 70 revolutions a minute, producing 100,000 cubic feet of air a minute, with a water-gauge of 2 inches. There is also an emergency exhaust-fan stationed at Newcastle Island shaft ready for use.

The coal is hauled out of No. 1 level to No. 1 shaft by six electric motors of the trolly type—four Edison, one Westinghouse, and one tandem of the Jeffery type—all doing very efficient work.

On my last examination I found 63,000 cubic feet of air a minute passing into this section, divided into three splits.

No. 3 Slope.

There was 13,000 cubic feet of air a minute passing into the slope for the use of fifty-eight men and eight horses, or an average of 159 cubic feet of air for each unit employed.

No. 1 Split, North Side of No. 2 Slope.

There was 12,200 cubic feet of air a minute passing into the split for the use of forty men and seven horses, or an average of 200 cubic feet of air for each unit employed.

No. 2 Split, No. 2 Slope.

There was 6,000 cubic feet of air a minute passing into the split for the use of thirty men and four horses, or an average of 142 cubic feet of air for each unit employed.

No explosive gas found in these sections; timbering and roadways good. The sections are free from coal-dust.

Protection Pillars, Protection Shaft.

I examined all available parts of the pillars and found them free from gas, well ventilated, and the faces well cogged up.

This shaft is used only for the rising and lowering of the workmen engaged in the North side of the mine. The only operations carried out are extracting of pillars for generating power supplied to mining-machines and winches, etc.

Machinery installed: Three Canadian Rand compressors, two 2,500 and one 1,800 cubic feet of air a minute.

Safety-lamps are used in all parts of the mine. Permitted explosives are used for breaking the coal, fired by electric batteries. The section is fairly free from coal-dust; no explosive gas found.

No. 1 Slope.

There was 5,000 cubic feet of air a minute passing into the section for the use of twenty men and three horses, or an average of 172 cubic feet of air for each unit employed. Timbering and roadways good. The section is free from coal-dust; no explosive gas found.

South Side of No. 1 Mine.

Robert Laird, Overman of the Section; Moses Woodburn, Henry Ernest Devlin, James Richards, Joshua Norris, Ike Hill, Francis Green, Joseph William Dykes, William Brown, James Wardrope, Matthew Broderick, and James Gray, Firemen.

The ventilation of the south side is produced by a 72- x 90-inch double-inlet Sirocco fan, rope-driven, ratio 3½ to 1, running 250 revolutions, producing 195,000 cubic feet of air a minute, with a 4-inch water-gauge, and an engine of 350 horse-power. A second Sirocco fan of the same size, in every way modernly equipped, is kept under steam in case of emergency.

Nothing but safety-lamps of the Wolf pattern and Edison electric head-lamps are used. Permitted explosives are used, fired by batteries.

The haulage from this section is by main-and-tail rope and endless-rope system. The production of the mine is 1,400 tons a day.

This section of the mine forms the deepest workings and is worked on the pillar-and-stall system. The South-east levels have reached the boundary which divides the Reserve mine and the South side of No. 1 mine, and are on the retreat.

To overcome the many dangers of being caught by cars in this district, all drivers, rope-riders, and trackmen are equipped with the Edison head-lamp.

On my last inspection I found 33,300 cubic feet of air a minute passing into the section, divided into two splits.

Simms Dips, No. 1 Split.—There was 7,580 cubic feet of air a minute passing into the split for the use of seventeen men and two horses, or an average of 326 cubic feet of air for each unit employed.

No. 2 Split, South-east Heading.—There was 10,500 cubic feet of air a minute passing into the split for the use of forty men and ten horses, or an average of 150 cubic feet of air for each unit employed. A little gas found at the head of Charnock's place; timbering and roadways fair. The section is fairly free from coal-dust.

No. 2 South Level.

There was 4,000 cubic feet of air a minute passing into the section for the use of eighteen men and three horses, or an average of 150 cubic feet of air for each unit employed.

No. 7 Level.

There was 9,000 cubic feet of air a minute passing into the section for the use of thirty-three men and four horses, or an average of 200 cubic feet of air for each unit employed. No explosive gas found; timbering and roadways good. The section is fairly free from coal-dust.

Workings above No. 1 North Level.

There was 4,000 cubic feet of air a minute passing into the section for the use of nine men and one horse, or an average of 363 cubic feet of air for each unit employed. No explosive gas found; timbering and roadways good. The section is fairly free from coal-dust.

The following are the official returns from the No. 1 shaft and Protection Island collieries for the year 1918:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	192,053			
" export to United States	98,926			
" " other countries	10,128			
Total sales		301,107		
Used in making coke				
Used under colliery boilers, etc.	50,071			
Total for colliery use		50,071		
Lost in washing		12,472		
Stocks on hand first of year	1,033			
" last of year	34,067			
Difference added to stock during year		33,034		
Output of colliery for year		396,684		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	19		14		33	
Whites—Miners	243	5.50-8.05			243	
Miners' helpers	8	4.96-5.50			8	
Labourers	170	4.96-7.10	27	5.01-5.50	197	
Mechanics and skilled labour	67	5.50-6.75	71	5.50-6.83	138	
Boys	28	2.73-4.96	23	1.98-3.92	51	
Japanese						
Chinese			84	3.30-3.94	84	
Indians						
Total	535		219		754	

The mine operated 300 days.

RESERVE MINE.

James Dickson, Manager; Francis John, Overman; Albert Manifold, Harry Allsopp, Robert Smith, John Ovington, George Oswald, Frederick Bell, J. Devoy, John McCourt, Alex. Young, George Frater, and Benjamin Cheetham, Firemen.

The mine is situated in what is known as the Cranberry district, about five miles south of No. 1 Shaft, Nanaimo, B.C. The coal is reached by two shafts at a depth of 955 feet, from which a rock tunnel 8 x 10 feet in area is driven across the measures on a 1-per-cent. grade to the rise. The tunnel tapped the seam at a distance of 180 feet.

The shaft-bottom is laid out in a most up-to-date method for handling large quantities of coal. All the tracks are laid with 30-lb. rails and on a grade of 1 per cent. from the shaft. All the main tunnels leading to this shaft are timbered with 12- x 12-inch timbers.

The seam worked in this mine is the Douglas, the thickness of which varies from 1 to 20 feet. The pitch varies from 10 to 50 degrees and is generally dipping north or north-east. The coal is mostly of a soft nature, with a fairly strong shale roof, while the floor is generally black shale, sometimes mixed with boulders of hard rock.

The main development of the mine has been carried on by means of three pairs of headings, which have been driven due south, each pair being about 1,000 feet apart.

The coal in the No. 1 South heading varies from 5 to 10 feet in thickness and is of a very hard nature. There is a diamond-drill hole down a considerable advance behind this heading and in about 9 feet of coal. If the present thickness of coal continues in this No. 1 West heading, a large tunnel will be driven on a 1-per-cent. grade, back of No. 1 hoisting-shaft, and connect with the shaft about 150 feet from the present shaft-bottom.

The headings have been driven about 1,000 feet to date, and vary in pitch from 10 to 40 degrees, while between the bottom of these headings and the Main level there is a displacement of fully 100 feet. The coal is handled by means of chutes between the headings and the level, which causes considerable breakage of the coal.

A shaft has been raised 110 feet and fitted with a balance cage to allow the cars to be taken directly into one of the heading sections. The irregular pitch and varying thickness of the coal made it difficult to deal with the haulage from the face to the shaft with the large capacity car which was installed when the mine was started.

The mine-car had a capacity of 2 tons and the track-gauge was 42 inches, both of which were unsuited to the conditions as found. It was decided to change to a smaller capacity car and a narrower gauge, so the large cars were taken out of the mine and all the tracks changed to 36-inch gauge, and a smaller car with a capacity of 1 ton introduced. This allowed the cars to reach the faces in some of the sections which up to this time had depended on chutes to deliver the coal to the Main level.

The ventilation of the mine is produced by a pair of 90-inch Sirocco fans, connected to a 20 x 30 engine, rope-driven. On the engine is a drive-wheel 17 feet in diameter, and on the fan-shaft a drive-wheel 5 feet in diameter; these fans, running with an engine-speed of 16 revolutions a minute, produce 140,000 cubic feet of air a minute in the fan-drift, with a 3-inch water-gauge. The fan and engine are installed on a concrete foundation 80 feet from the shaft.

The air is carried along the main levels on both sides of the mine and maintained by permanent stoppings of 12- x 12-inch timbers between intake and return airways, these being kept close up to the face of the levels. The main intakes are naturally damp and systematic watering is carried out in the main places and around the chutes. There is very little gas found in the workings and analysis of the returns shows a low percent.

The mechanical haulage is all carried on by means of compressed-air winches, of which there are twelve in use. The pillars have been withdrawn in two small prospect sections which did not prove of sufficient value to warrant their continuation. One section in which pillars were being withdrawn was stopped owing to striking a fairly large feeder of water.

On my last examination I found 63,000 cubic feet of air a minute passing into the mine, divided into four splits.

No. 1 Split, East Side.—There was 19,200 cubic feet of air a minute passing into the split for the use of forty men and four horses, or an average of 368 cubic feet of air for each unit employed.

No. 2 Split.—There was 6,000 cubic feet of air a minute passing into the split for the use of eight men, or an average of 750 cubic feet of air for each unit employed.

No. 1 Split, West Side.—There was 17,000 cubic feet of air a minute passing into the split for the use of forty men and three horses, or an average of 347 cubic feet of air for each unit employed.

No. 2 Split.—There was 2,200 cubic feet of air a minute passing into the split for the use of twenty-five men and three horses, or an average of 650 cubic feet of air for each unit employed.

Timbering and roadways good. A small cap of gas in the Main level, off No. 2 West incline. The mine is fairly free from coal-dust.

The following are the official returns of the Reserve Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	52,700			
" export to United States	27,165			
" " other countries	2,781			
Total sales		82,646		
Used in making coke				
Used under colliery boilers, etc	18,615			
Total for colliery use		18,615		
Lost in washing		3,700		
Stocks on hand first of year	1,438			
" last of year	3,142			
Difference added to stock during year		1,704		
Output of colliery for year		106,665		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	9		8		17	
Whites—Miners	80	5.50-8.13			80	
Miners' helpers						
Labourers	56	4.96-5.50	11	5.01-5.50	67	
Mechanics and skilled labour	26	5.50-6.18	31	5.50-6.59	57	
Boys	15	2.73-4.29	11	2.25-3.92	26	
Japanese						
Chinese			45	3.30-3.74	45	
Indians						
Totals	186		106		292	

The mine operated 302 days.

HAREWOOD MINE.

Richard Battey, Manager; John White, Overman; James Handlen, John Docherty, Thomas Reid, John Kirkwood, Alex. Bryden, John C. Hughes, William Watson, Harry Carroll, William Robinson, and Robert Henderson, Firemen.

Harewood mine was first opened about forty years ago, when the coal-outcropping at the bluff was worked for a small area and operations suspended.

The mine was again opened in 1902, when a shaft was sunk to the dip of the old workings, entering the seam at a depth of 150 feet. Coal was worked to the rise and a pair of headings driven up to the old workings, when operations were again suspended in 1904.

The present operations were commenced in 1917. In August the tunnel driven by the first operations was cleared out, and the coal was reached about 1,000 feet from the present tunnel. Operations on the coal were commenced at the top of the old slopes, when skips were taken from the pillars until the coal-faces were reached, when a level was commenced and driven until a fault was struck in May, 1918. Prospecting was continued, but up to the present time coal has not been found in any quantity, although an old prospect-tunnel about 1,000 feet ahead of the faces is supposed to have 5 feet of coal.

At a point where the original face was, an incline was driven up and holed at the surface outcrop in the bluff 1,200 feet south of the old entrance. Coal is being worked to the right and left of this incline and varies from 2 to 12 feet in thickness.

At a distance of 800 feet from the bottom of this incline there is what is called No. 2 incline, where coal is also worked to the right and left. At the face of the incline, about 600 feet from the level, a large fault was encountered which cut out the coal entirely, and although prospected a short distance, no results were obtained. They are now trying to work around this roll from the left side of No. 1 incline. The coal at this point is 12 feet thick.

The other workings are to the dip of No. 1 level, and the old slope is used as a haulage-road. No. 2 level is some 300 feet down and runs parallel to No. 1 level. Narrow skips were taken from the bottom of the pillars to make a roadway to the old face, where rock was encountered in such quantities that operations were suspended. The workings at the present are to the dip of this level and about 300 feet from the old face. This level has been driven about 750 feet from the level, but so far has been unable to penetrate through the rock to the south. Most of the working-faces are now being driven in the direction of the old slope and expect shortly to hole into the old pillars that were worked from the old shaft. The coal was taken out of the pillars between Nos. 1 and 2 levels during the operations in 1902 and 1904.

No. 3 level is some 250 feet farther down the slope from No. 2, to which it runs parallel, and coal was worked to the dip until operations were suspended by a series of large faults. These pillars and the pillars between Nos. 2 and 3 levels are left and will not be extracted until the last operations. This No. 3 level is abandoned and now used as a return airway.

Nos. 4, 5, and 6 levels were started from the slope and driven in the same direction as the other levels. The area here was so broken up by faults that No. 6 was cut out and No. 5 driven up to No. 4, and this level now carries all the workings which were holed through to the places from the dip of No. 2 level. Pillars are now being drawn in this district to a line of gob formed by pillars drawn to the rise of No. 4 level, where operations in this section will stop.

A No. 7 level was commenced farther down the slope, but discontinued after two months' prospecting in rock. On the left side of the slope only two levels were started opposite Nos. 3 and 4 levels and driven in a northerly direction, but encountered rock, and the pillars were withdrawn, with the exception of three left as a barrier to the slopes; but as a new slope is now being driven from the dip road in No. 2 level up to No. 1 level, these pillars are now being extracted.

The haulage is performed by two electric locomotives and three electric hoists. The motors are used on the Main and No. 1 levels, and winches are used, one to pull out of No. 2 level dips, one from the slope, and one on No. 1 incline. The coal is all concentrated on No. 1 level and taken to the tunnel-mouth by the motors.

The air-current is at present divided into three splits, and there are two intakes, one by way of the tunnel and the other from the opening at the outcrop at the bluff. This current supplies No. 1 split, which comprises the workings of Nos. 1 and 2 inclines, and is passed over Nos. 1 and 2 levels by overcasts, returning down old No. 3 level over the slope and overcast to the counter-

slope, and thence to the upcast shaft. No. 2 ventilates the No. 1 level and is taken from the tunnel intake current. After passing the working-faces the air joins No. 1 split air below No. 1 level overcast. The No. 2 split ventilates Nos. 2 and 3 levels and is taken down the slope for the tunnel intake, and after passing around the working-places is taken down the Main slope to the shaft.

The ventilation is produced by a Murphy fan placed near the top of the shaft. The pressure is 2.5 lb. to the square foot, and the total quantity is about 41,700 cubic feet a minute.

The power-house is also situated at the shaft and comprises two return-tubular boilers of 120 horse-power each and a Nagle engine coupled direct to the generator. The voltage is 250, with a capacity of 750 amperes. The screening plant comprises one shaker and one revolving screen, with a revolving dump, all of which are electrically driven.

In the shaft a manway is provided with ladders; a pump is stationed at the bottom to handle the mine-water. The drainage to this point is by gravity, and although the mine is fairly dry, considerable surface water is handled in the winter.

The future operations greatly depend on the prospecting in No. 1 level and the prospect about to start in No. 2 level. The new slope from No. 2 level dips will be an improvement to the haulage being more direct.

Pillars will be drawn on both Nos. 1 and 2 inclines when the stalls are driven up to the outcrop, and barriers will be left for the protection of No. 1 level. When No. 2 level dip-workings hole into the old pillars, part of these may be withdrawn, but a roadway will be left to be used as a return airway and drainage.

On my last examination I found 41,700 cubic feet of air a minute passing into the mine, divided into three splits.

No. 1 Split.—There was 24,700 cubic feet of air a minute passing into the split for the use of sixty men and six horses, or an average of 303 cubic feet of air for each unit employed.

No. 2 Split.—There was 9,000 cubic feet of air a minute passing into the split for the use of eleven men and two horses, or an average of 539 cubic feet of air for each unit employed.

No. 3 Split.—There was 8,000 cubic feet of air a minute passing into the split for the use of twenty-four men and four horses, or an average of 222 cubic feet of air for each unit employed.

Timbering and roadways good. No explosive gas found. The mine is free from coal-dust.

The following are the official returns of the Harewood Colliery for the year ending December 31st, 1918:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	130,859			
" export to United States	67,389			
" " other countries	6,901			
Total sales		205,149		
Used in making coke				
" under colliery boilers, etc	7,777			
Total for colliery use		7,777		
Lost in washing		15,100		
Stocks on hand first of year	5,537			
" last of year	6,083			
Difference added to stock during year		546		
Output of colliery for year		228,572		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	8		7		15	
Whites—Miners	114	5.50 - 9.13			114	
Miners' helpers	1	4.96			1	
Labourers	36	4.96 - 5.50	10	5.01 - 5.50	46	
Mechanics & skilled labour.	14	5.50 - 6.25	27	5.50 - 6.35	41	
Boys	7	2.73 - 4.29	9	2.25 - 3.92	16	
Japanese						
Chinese			39	3.62 - 3.84	39	
Indians						
Totals	180		92		272	

The mine operated 301 days.

British Columbia Coal Mining Co., Ltd.

(SUCCESSOR TO VANCOUVER-NANAIMO COAL MINING CO., LTD.)

Head Office—Nanaimo, B.C.

Capital, $300,000.

Officers.	*Address.*
William Warner, President,	17 Williams Bldg., Vancouver, B.C.
Howard Gallagher, Secretary-Treasurer,	P.O. Box 834, Nanaimo, B.C.
S. K. Mottishaw, Superintendent,	Nanaimo, B.C.

Value of plant, $100,000.

NEW EAST WELLINGTON COLLIERY.

Samuel K. Mottishaw, Manager; Joseph Thompson, Overman; Ike Nash and James Bullen, Firemen.

The mine is situated two miles due west from the city of Nanaimo, on Ranges 10 and 11, in the Mountain district, and is on the Old Wellington seam. It is penetrated by two slopes running N. 70° E., and pitching about 35 degrees, for a distance of 1,400 feet. At this point headings are turned off N. 65° E., which have reached the boundary. At a distance of 300 feet from the foot of the slope on No. 1 East level, dip-workings are driven N. 15° E. to the boundary.

All the solid work being finished, the pillars are now being drawn back. The coal varies from 4 to 8 feet in thickness and is worked by the pillar-and-stall methods.

Wolf safety-lamps and permitted explosives, fired by batteries, are used throughout the whole mine. The mine is equipped with two 2-hour and one ½-hour Draeger oxygen apparatus, one pulmotor, and four Ceag electric lamps.

The ventilation of the mine is produced by a Browning reversible fan, with a capacity of 100,000 cubic feet of air a minute, coupled to a 74-horse-power, 12 x 16 Houston, Stanwood & Gamble engine, making 250 revolutions a minute, with a 2½-inch water-gauge; also a 4 x 9 Sheldon fan, kept ready under steam in case of emergency.

A gob-fire broke out at 3 a.m. on the morning of October 5th, 1917, in the old worked-out area of No. 5 West level, and after an examination of the same, accompanied by Chief Inspector Wilkinson, we found that owing to the extracted area and the remaining pillars being so small it was utterly impossible to erect permanent stoppings near the fire area, and it was decided to erect the stoppings in the Main and Return slopes. This was successfully done on October 7th, 1917.

On November 22nd, 1917, after samples of the mine-air taken at the return stoppings, it was decided to open the stoppings again, and the work of removing the gases was proceeded with up to November 28th, when it was discovered that the fire was not extinguished; consequently the mine was sealed off again on November 29th, remaining closed until August 10th of the present year, when the mine was unwatered and operations begun.

On my last examination I found 30,600 cubic feet of air a minute passing into the mine for the use of forty men and four horses, or an average of 588 cubic feet of air for each unit employed. Timbering and roadways fair. A little explosive gas found in No. 3 East and at the top stopping at No. 5 West. The mine is fairly free from coal-dust.

The following are the official returns for the year ending December 31st, 1918:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	4,815			
" export to United States	4,679			
" " other countries				
Total sales		9,494		
Used in making coke				
Used under colliery boilers, etc.	3,970			
Total for colliery use		3,970		
Stocks on hand first of year				
" last of year	604			
Difference added to stock during year		604		
Output of colliery for year		14,068		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	5		3		8	
Whites—Miners	36	7.25			36	7.25
Miners' helpers						
Labourers	7	4.81	2	4.50	9	4.68
Mechanics and skilled labour	3	5.79	10	5.87	13	5.83
Boys						
Japanese						
Chinese			13	3.27	13	3.27
Indians						
Totals	51		28		79	

Name of seams or pits—Wellington seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—The coal varies in thickness from 4 to 8 feet, and is reached from the surface by two slopes running N. 70° E. and pitching about 35 degrees down a distance of 1,400 feet. At this point headings are turned off N. 65° E. and are driven up to the boundary. All of the work in this mine is devoted to the extraction of the pillars.

Description and length of tramway, plant, etc.—The hoisting plant consists of a direct-haulage 10- x 12-inch Washington hoist. The coal is screened over a Marcus screen. The power plant consists of three return-tubular boilers of 80 horse-power each and two Canadian Rand air-compressors having a capacity of 600 cubic feet of free air. The mine is connected by two miles of railway to a shipping-point situated on Newcastle townsite; the railway also connects with the Esquimalt & Nanaimo Railway. The coal is dumped into bunkers having a capacity of 1,000 tons, from which it is conveyed to ships by a self-acting incline. There is also a small sawmill at which the mine timber is cut. The ventilation of this mine is produced by a Browning fan, 4 x 10 feet, driven by a 10- x 12-inch Fairbanks-Morse engine making 165 revolutions a minute, with a water-gauge of 2.4 inches.

Pacific Coast Coal Mines, Limited.

Head Office—Victoria, B. C.

Capital, $3,000,000.

Officers.	*Address.*
James Carruthers, President,	Montreal, Que.
J. H. Paine, Vice-President and Managing Director,	Victoria, B.C.
Douglas Muir, Secretary-Treasurer,	Victoria, B.C.
Robert Bonar, Superintendent,	South Wellington, B.C.

MORDEN MINE.

Robert Bonar, Manager; Thomas Taylor, Overman; John Donnachie, Edward J. Parrott, Neil McIntyre, and Peter Carr, Firemen.

This mine is operated on the Douglas seam, and is situated on Section 11, Range 8, Cranberry district, and about two miles from the town of South Wellington.

The plant consists of three 150-horse-power Goldie & McCulloch 72- x 18-inch boilers, 160 lb. working-pressure; one pair 24 x 36 hoisting-engines equipped with safety overwinding device, steam-brake; two 10-foot sheaves with collars and boxes and two self-dumping cages; one Gwynnes 5-inch centrifugal pump direct-connected to 250-volt a.c. motor; two 150-kw. electrical generators connected to two Goldie & McCulloch 13 x 20 x 9 high-speed engines; five electrical motors, 400-volt, Iron Works fan-engine; one Marcus screen 65 feet long, one Marcus screen 63 feet long, both with double decks and doors; one Weir feed-pump.

The mine is penetrated by two shafts sunk to a depth of 600 feet; the main shaft is 9 x 16 feet and the air-shaft 9 x 12 feet in the clear.

A new shaft-bottom has been completed below the level of the old one, with two slopes driven direct from the bottom of the shaft, which will pass through the centre of the company's property.

The ventilation is produced by a Sheldon double-entry fan 7 feet in diameter, at from 3- to 3½-inch water-gauge, at 250 revolutions a minute. A 16- x 12-inch engine, made by the Vulcan Iron Works, drives this fan, the fan being built on reinforced-concrete foundation. There has also been installed an up-to-date motor ambulance, which has been a great benefit not only to the mine, but to the surrounding district as well, during the recent "flue" epidemic.

Extensive development underground has been carried on during the year. The new shaft-bottom has been widened to allow the handling of more coal. The Main slope has been driven through almost 900 feet of rock-fault and has again struck the coal; although only 4 feet high, it is of a very good quality. A main diagonal slope has been turned off the Main slope, and will replace the old slope which has been abandoned on account of the haulage system. This new development-work is being pushed ahead as speedily as possible, as the Main slope, striking this big fault, seriously delayed development.

The coal is well adapted for steam purposes, and varies from 3 to 30 feet in thickness.

The mine is worked exclusively by safety-lamps of the Wolf pattern; only permitted explosives are used, fired by electric battery.

No. 4 shaft or return-air shaft is now being used exclusively as an emergency shaft. An engine with steam on and a hoisting-cage in the shaft is always ready to hoist the men in case of emergency.

On my last inspection I found 50,000 cubic feet of air a minute passing into the mine, divided into two splits.

No. 1 Split.—There was 20,000 cubic feet of air a minute passing into the split for the use of twenty men and one horse, or an average of 900 cubic feet of air for each unit employed.

No. 2 Split.—There was 25,000 cubic feet of air a minute passing into the split for the use of thirty men and four horses, or an average of 595 cubic feet of air for each unit employed.

A little gas found in Merriner's place, No. 4 Right. The mine is fairly free from coal-dust. Timbering and roadways fair.

The following are the official returns for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	33,934			
" export to United States	36,274			
" " other countries				
Total sales		70,208		
Lost in washing	16,525			
Used under colliery boilers, etc.	17,905			
Total for colliery use		34,430		
		104,638		
Stocks on hand first of year	22,419			
" last of year	410			
Difference taken from stock during year		22,009		
Output of colliery for year		82,629		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	9	5.75	6	6.25	15	5.75 - 6.25
Whites—Miners	65	5.82			65	5.82
Miners' helpers						
Labourers	38	4.30			38	4.30
Mechanics and skilled labour	2	3.87 - 4.70	38	3.87 - 5.90	40	3.87 - 5.90
Boys			3	2.30	3	2.30
Japanese						
Chinese			45	2.70	45	2.70
Indians						
Totals	114		92		206	

Name of seams or pits—Working on the upper Douglas seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—At the Morden mine coal is reached by means of shafts: No. 3 shaft, 655 feet in depth, 10 x 18 feet in the clear; No. 3 air-shaft, 630 feet in depth, 10 x 10 feet in the clear. Upcast air-shaft is also equipped

with steam-hoist and cage as the emergency outlet. All machinery for handling coal is electrically driven.

Description and length of tramway, plant, etc.—At Morden mine the plant consists of three 150-horse-power and two 100-horse-power return-tubular boilers; one pair 24 x 36 hoisting-engines with safety overwinding device, with steam-reverse and steam-brake; two 10-foot sheaves and two self-dumping cages; one Canadian Rand cross-compound air-compressor; two 150-kw. electrical generators connected with 13 x 20 x 9 high-speed engines; one Sheldon ventilating mine-fan, direct-connected to a 17 x 20 engine, also motor-driven as auxiliary. There is a thoroughly equipped machine-shop and also mine-rescue station, containing two sets Gibbs rescue apparatus complete, capacity four to eight hours. A standard-gauge railway seven miles and a half long connects the mines with Boat Harbour, the shipping-point, equipped with wharves and bunkers which will accommodate the largest ocean-going steamers.

The Nanoose Collieries Co., Ltd.

Head Office—Vancouver, B.C.

Capital, $50,000.

Officers.	*Address.*
W. J. Vanhouten, President,	Vancouver, B.C.
W. H. Wilson, Secretary-Treasurer,	Vancouver, B.C.
J. J. Grant, Superintendent,	Wellington, B.C.

Value of plant, $52,300.

NANOOSE COLLIERIES.

John John, Manager; John Michie, John McLeod, and Edward Bridges, Firemen.

This mine is situated at Nanoose Bay, about five miles in a north-westerly direction from what is known as North Wellington, which was formerly worked under the old Dunsmuir Company, and is known as the Old Wellington seam.

A shaft 8 x 16 was sunk on the property a distance of 133 feet, with levels turned off east and west. The coal varies from 3 to 4 feet in thickness, lying in two benches, with rock varying from 2 to 5 feet in thickness between the coal.

The East level has been driven through the fault into the property of the Canadian Collieries Company, where good coal has been struck, varying from 4 to 6 feet in thickness, with a bench of rock running through the centre, varying from 1 to 3 feet.

A new head-frame has been erected with a capacity of handling 500 tons a day. The new loading-wharf has been completed. A number of cottages have been built on the Comox road to accommodate the workmen of the mine. A new hoist and boilers have also been completed.

The ventilation of the mine is produced by a small fan capable of producing 14,000 cubic feet of air a minute. The mine is worked on the pillar-and-stall system, with permitted powders, fired by batteries. Open lights are used, as there never has been any gas found.

On my last examination I found 14,000 cubic feet of air a minute passing into the mine for the use of twenty-seven men and two horses, or an average of 424 cubic feet of air for each unit employed. Timbering and roadways good. No explosive gas found. The mine is free from coal-dust.

During all examinations I examined all record-books under section 91, subsections (4) and (36), of the "Coal-mines Regulation Act," and found the provisions of the above Act carried out.

The following are the official returns for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	11,669			
" export to United States	12,587			
" " other countries				
Total sales		24,256		
Used in making coke, unsaleable slack	3,145			
Used under colliery boilers, etc	1,403			
Total for colliery use		4,548		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of collieries for year		28,804		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	3		3		6	
Whites—Miners	32				32	
Miners' helpers						
Labourers	15		4		19	
Mechanics and skilled labour			4		4	
Boys			3		3	
Japanese						
Chinese			14		14	
Indians						
Totals	50		28		78	

Name of seams or pits—Grant mine, Wellington seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Seam consists of two layers of coal, upper and lower bench, with clay and shale between, varying in thickness from 1 to 4 feet; total thickness of seam, from 8 to 10 feet. Method of working is pillar and stall. Entries driven on strike of seam 12 feet wide, height of seam. Stalls driven to rise, double-stalls track on each side, with gob in centre. Average dip of seam is about 7 degrees. Levels at present 1,800 feet long in a south-easterly direction from shaft-bottom. Shaft 8 x 16, three compartments, 129 feet deep. Return airway is rock-drift from coal-seam to surface on a 22-degree pitch; size 6 x 12.

Description and length of tramway, plant, etc.—Plant is located on beach, about four miles south of Nanoose Bay. Loading-wharf is 500 feet long. Working plant consists of return-tubular boiler, 88 horse-power, double-drum hoist, drums 30 inches in diameter, engine-cylinders 12 x 16 inches. Air-compressor, 225 cubic feet free air a minute. Revolving screen for nut and pea coal; lump screened over bar screen. Machine-shop is equipped with lathe,

drill-press, emery-wheels, and necessary tools, operated by 7-horse-power upright engine. Complete blacksmith-shop. Ventilation system operated by standard 8-foot fan, capacity 25,000 cubic feet, driven by Leonard engine, 25 horse-power. Electric-lighting plant, 125-light capacity.

COMOX INSPECTION DISTRICT.

REPORT OF HENRY DEVLIN, INSPECTOR.

I have the honour to submit my annual report as Inspector of Mines for the Comox Inspection District of Vancouver Island for the year ending December 31st, 1918, together with a list of all accidents and colliery returns.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

Capital, $15,000,000.

Officers.	*Address.*
Henry S. Fleming, President,	New York.
F. Perry, Vice-President,	Montreal, Que.
H. S. Adlington, Secretary-Treasurer,	Montreal, Que.
J. M. Savage, General Manager,	Victoria, B.C.
Thos. Graham, General Superintendent,	Cumberland, B.C.

The Canadian Collieries (Dunsmuir), Limited, in 1910 acquired all the holdings of the Wellington Colliery Company, Limited, and since then has been operating the following mines:—

The Extension Colliery, in the Cranberry District (Extension); T. A. Spruston, manager.

The Comox Colliery, in the Comox District; J. W. Montgomery, George O'Brien, J. G. Quinn, managers at the several mines.

The following table shows the combined output of all this company's collieries during the past year:—

RETURNS FROM THE CANADIAN COLLIERIES, LTD., MINES FOR YEAR 1918.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	343,707		24,501	
" export to United States	151,611			
" " other countries	38,607			
Total sales		533,925		24,501
Lost in washing	185,963			
Used in making coke	40,172			
Used under colliery boilers, etc.	27,747		115	
Total for colliery use		253,882		115
		787,807		24,616
Stocks on hand first of year	3,345		1,473	
" last of year	7,368		1,744	
Difference added to stock during year		4,023		271
Output of collieries for year		791,830		24,887

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	82		36		118	
Whites—Miners	431				431	
Miners' helpers	6				6	
Labourers	181		74		255	
Mechanics and skilled labour	161		174		335	
Boys	17		10		27	
Japanese	97		1		98	
Chinese	438		263		701	
Indians						
Totals	1,413		558		1,971	

COMOX COLLIERIES.

These mines were formerly operated by the Wellington Colliery Company, but were taken over by the Canadian Collieries (Dunsmuir), Limited, in 1910. The mines are situated in the Comox district, about seventy miles from Nanaimo. A railway about twenty miles in length connects the various mines to a shipping-point at Union Bay, over which the whole output is conveyed.

This Company is operating in Cumberland mines known as Nos. 4 and 7 slopes and Nos. 5, 6, and 8 shafts. The new railway connects with the several mines in this district, thus doing away with the heavy grade on the old line. Nos. 4, 5, and 7 mines have been in continuous operation throughout the year; but there have been no operations in either No. 6 or No. 8 mines during the present year.

The Hydro-electric Plant.

This plant has been in continuous operation throughout the year. The power-house has been operated satisfactorily and no repairs or improvements were needed. The output of power shows the same steady increase as in former years.

Union Bay.

At Union Bay the coke-ovens have been in continuous operation during the entire year.

A new machine-shop has been installed in Cumberland to take care of the small repair-work around the mines. This contains two lathes, drill-press, hack-saw, and punch and shear. The electrical winding department has been moved from Union Bay to this shop.

One diamond-drill has been running continuously in the field during the year. A new road has been opened from the Island highway up Tsaabl river, about five miles south of Union Bay, to take in a drill to prospect some territory about five miles up the river, where some very likely looking prospects are showing. This drill is expected to be working early in the new year.

No. 4 Mine, Comox.

George O'Brien, Manager; Robert Adamson, Overman, No. 1 Slope; Charles Parnham, Overman, No. 2 Slope; John Bennie and James Quinn, Shiftbosses; Sidney Horwood, Arthur William Watson, Thomas Richards, Arthur Phelan, Daniel Parks Marsh, Peter Myers, William Beveridge, Thomas Eccleston, Robert Reid, Robert Ewing, John George Biggs, Richard Henry Hodson, Louie Franscescini, John Liddle, Daniel McMillan, and Frederick Hutchinson, Firebosses.

This mine is situated about two miles from Cumberland and about twenty miles from the shipping-point at Union Bay.

The ventilation is produced by a Sullivan reversible fan driven by a 350-horse-power motor, direct-coupled, running at 245 r.p.m., and capable of delivering 196,000 cubic feet of air a minute, against a 7-inch water-gauge.

This mine has been in continuous operation during the year. Safety-lamps of the Wolf type and the Edison electric head-lamp are used exclusively in this mine, and where blasting is permitted it is done with permitted explosives fired by electric battery.

New Work at No. 4 Mine.

On both Nos. 1 and 2 slopes tail-ropes were necessary to carry empty trips into the mine on account of an adverse grade near the mouth of the mine. A rock tunnel was started directly over the slopes, the thickness of strata being 15 feet between the roof of the old tunnel and the floor of the new tunnel.

At the turn-off to No. 2 slope a curve with a radius of 124 feet was put in. The tunnels were driven until the timbers on the old slope were struck. The roof was then brushed through on a week-end. A new tipple approach was built over the old tipple approach; this was built so as to conform with the new tipple plans. When the inside work was ready this new tipple approach was temporarily connected to the old tipple. This work was completed without any loss of time to the mine.

A new tipple is being erected at this mine. This tipple is being built alongside the present tipple and will be equipped with a Marcus screen. It is expected to have this in operation early in January. A new lamp-room has been completed and equipped with electric lamps, and all necessary appliances for charging and upkeep.

No. 1 Slope.

This slope is down a distance of 7,000 feet, running due north. A Diagonal slope, 4,000 feet from the entrance of the mine, running N. 45° E., is down a distance of 4,000 feet, where levels are turned off east and west—Nos. 15, 16, 17, 18, 19, and 20 on the West side. There are no operations on the East side of No. 1 slope at the present time, No. 19 East level being used as a travelling-road between Nos. 1 and 2 slopes.

The new slope driven off No. 15 West level, No. 1 slope, has been driven ahead and two levels turned off. These levels are in good coal ranging from 5 to 7 feet in height, with a band of rock running in the centre from 12 to 15 inches thick, having a fairly good roof. No. 1 slope has not advanced any during the year.

During my last inspection in December I measured 22,500 cubic feet of air a minute passing into No. 1 slope for the use of sixty-five men and eleven mules, or an average of 229 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in a crosscut off No. 20 West level and a 1-inch gas-cap in No. 22 pillar in No. 18 West level; also found a slight gas-cap travelling in the air-current between Nos. 18 and 20 West levels. I found the timbering and roadways in fair condition.

No. 2 Slope.

This slope branches off No. 1 slope a short distance from the mouth of the tunnel, running N. 45° E., and is down a distance of 9,000 feet and forms the deepest workings of the mine.

No. 2 slope has not advanced any during the year. Considerable repair-work has been done in the return air-courses and stoppings built between the intake and return airways in No. 2 slope during the year.

Levels are turned off this slope east and west—Nos. 15, 16, 17, 18, 19, and 20 on the West side, and Nos. 15, 16, 17, 18, 19, and 20 on the East side. Nos. 20 East and 20 West are the only levels advancing, and are both in good coal ranging from 4 to 6 feet thick, with a band of rock in the centre from 12 to 15 inches thick. On all other levels pillars are being extracted.

When I made my last inspection in December I measured 48,000 cubic feet of air a minute passing into No. 2 slope, divided into two splits.

In the East side split there was 16,800 cubic feet of air a minute passing for the use of forty-seven men and seven mules, or an average of 247 cubic feet of air a minute for each unit employed.

In the West side split there was 14,300 cubic feet of air a minute passing for the use of twenty-three men and four mules, or an average of 317 cubic feet of air a minute for each unit employed.

I found explosive gas in No. 23 stall and a crosscut off No. 23 stall, along the fault-line in No. 19 East level, and a ½-inch gas-cap in Nos. 16 East and 17 West pillars; also found a slight gas-cap travelling in the air-current on the return side of No. 19 East level. Found timbering and roadways in fairly good condition.

This mine is fairly free from coal-dust. I made tests with the Burrell gas-detector in the several splits and main return airways of this mine, with the following results: Split in No. 1 slope showing 1.5 per cent. methane in 15,000 cubic feet of air a minute; split on East side of No. 2 slope showing 1.5 per cent. methane in 25,200 cubic feet of air a minute; split on West side off No. 2 slope showing 1.4 per cent. methane in 16,000 cubic feet of air a minute; main return showing 1.2 per cent. methane in 130,200 cubic feet of air a minute.

No. 5 Mine, Comox.

William Walker, Manager; Robert Brown, Overman; Frank Crawford, Duncan Thomson, James Brown, Jasper Rutherford, Thomas Smith Wilson, John Ernest Spicer, William Bradley, Frederick Horwood, Thomas Shields, Samuel Jones, John D. Davis, and Robert Houston, Firebosses.

This mine has been in continuous operation during the year. The development of No. 1 dip is being carried on by four Sullivan type C.E. 7 coal-cutters. No. 2 dip is also being developed, this being the only new development in this mine during the year. A new lamp-room has been built and equipped for electric lamps. The full complement of lamps for this mine has not been yet received. The Sirocco fan for ventilating this and No. 6 mine has been in continuous service during the year and has proved satisfactory.

When I made my last inspection in December I measured 91,800 cubic feet of air a minute passing into the mine, divided into four splits.

In the split on the East side of No. 1 dip there was 17,800 cubic feet of air a minute passing for the use of fifty men and nine mules, or an average of 231 cubic feet of air a minute for each unit employed.

In the split on the West side of No. 1 dip there was 10,500 cubic feet of air a minute passing for the use of twenty men and one mule, or 456 cubic feet of air a minute for each unit employed.

In No. 2 dip split there was 20,000 cubic feet of air a minute passing for the use of forty men and three mules, or an average of 408 cubic feet of air a minute for each unit employed.

In the split on West side of shaft there was 25,000 cubic feet of air a minute passing for the use of forty-five men and eight mules, or an average of 362 cubic feet of air a minute for each unit employed.

I found timbering in good condition, with the exception of several places on the East side of No. 1 dip, which were not timbered in accordance with Special Rule No. 126. The attention of the manager was directed to this matter, with instructions to have same timbered properly. Roadways were in good order. I found no explosive gas in this mine. This mine is free from coal-dust.

I made tests with the Burrell gas-detector in the various splits and main return airways with the following results: Split on West side of No. 1 dip showing 0.3 per cent. methane in 11,000 cubic feet of air a minute; split on East side of No. 1 dip showing 0.5 per cent. methane in 19,200 cubic feet of air a minute; No. 2 dip split showing 0.3 per cent. methane in 21,200 cubic feet of air a minute; split on West side of shaft showing 0.2 per cent. methane in 26,400 cubic feet of air a minute. Combined return of Nos. 5 and 6 mines, between Nos. 1 and 2 inclines, showing 0.5 per cent. methane in 80,000 cubic feet of air a minute.

No. 6 Mine, Comox.

William Walker, Manager; Thomas Mordy, Overman.

No coal has been hoisted at this mine during the year. New arrangements have been made at this mine for water-hoisting. New buckets have been installed and the dumping facilities considerably improved. Practically all the water made in Nos. 5 and 6 mines is hoisted from No. 6 shaft.

When I made my inspection in December I measured 25,000 cubic feet of air a minute passing into the mine. I found a small quantity of explosive gas issuing from a break in the roof in a slant of No. 2 East level. I found timbering and roadways in fair condition.

No. 7 Mine, Comox.

John Graham Quinn, Manager; James Lawther Brown, Overman; Watkin Williams, James Monks, John Marsden, William James Keenan, Thomas Henry Nanson, Norman Wilson Huby, John McMurtrie, and Robert Walker, Firebosses.

This mine has been in continuous operation during the year. A borehole has been put down close to the bottom of the slope for water-discharge; the hole was put down by a churn-drill. A 6-inch pipe was put in and cemented. This will cut out the use of the discharge-line up the Main slope, a distance of over 5,000 feet. The depth of the drill-hole is 586 feet.

This mine is entered by means of two slopes, running N. 35° E., and is down a distance of 7,000 feet. The method of mining is the long-wall system. The seam varies from 2½ to 3½ feet thick and is of a very hard nature, being well adapted to this method of mining.

No. 1 Main Slope.

From this slope levels are turned off east and west—Nos. 3, 6, 7, 8, 9, and 10 on the West side, and Nos. 3, 7, and 9 on the East side.

No. 3 East Diagonal Slope.

This slope is driven off No. 3 East level at a distance of 500 feet from the Main slope and a distance of 2,000 feet from the entrance of the mine, running north-east. Levels are turned off on the East side only, owing to a fault running parallel to the slope on the West side; these levels are in good coal from 3 to 3½ feet thick.

The principal plant at this mine consists of a Sirocco fan with a capacity of 270,000 cubic feet of air a minute at a 5-inch water-gauge, driven by a 350-horse-power motor, and one electric haulage-engine driven by a 750-horse-power motor.

When I made my inspection in December I measured 89,000 cubic feet of air a minute passing into the mine, divided into four splits.

In No. 1 West split there was 7,400 cubic feet of air a minute passing for the use of twelve men and one mule, or an average of 493 cubic feet of air a minute for each unit employed.

In No. 2 West split there was 18,000 cubic feet of air a minute passing for the use of fifty men and seven mules, or an average of 253 cubic feet of air a minute for each unit employed.

In No. 1 East split there was 15,000 cubic feet of air a minute passing for the use of thirty men and three mules, or an average of 384 cubic feet of air a minute for each unit employed.

In No. 2 East split there was 10,000 cubic feet of air a minute passing for the use of twelve men and one mule, or an average of 666 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in No. 1 gateway, off No. 8 slant, No. 9 West level. The workmen were withdrawn from this place and the place fenced off pending the gas being removed. I found timbering and roadways in good condition. This mine is free from coal-dust.

I made tests with the Burrell gas-detector in the several splits and main return airways of this mine, with the following results: No. 1 West split showing 0.2 per cent. methane in 8,000 cubic feet of air a minute; No. 2 West split showing 0.3 per cent. methane in 18,700 cubic feet of air a minute; No. 1 East split showing 0.2 per cent. methane in 16,500 cubic feet of air a minute; No. 2 East split showing 0.2 per cent. methane in 10,850 cubic feet of air a minute; main return showing 0.4 per cent. methane in 96,000 cubic feet of air a minute.

Safety-lamps of the Wolf type and the Edison storage-battery electric lamp are used exclusively in No. 7 mine; all blasting is done with permitted explosives and all shots fired by electric battery.

No. 8. Mine, Comox.

This mine has not been operated during the year.

The following are the official returns from the Comox Collieries for the year ending December 31st, 1918:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	191,190			24,501
" export to United States	126,041			
" " other countries	38,607			
Total sales		355,838		
Used in making coke	40,104			
Used under colliery boilers, etc.	11,709			115
Lost in washing	129,418			
Total for colliery use		181,231		
		536,069		
Stocks on hand first of year	2,455		1,473	
" last of year	3,752		1,744	
Difference added to stock during year		1,297		271
Output of collieries for year		538,366		24,887

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	56		22		78	
Whites—Miners	157				157	
Miners' helpers						
Labourers	167		44		211	
Mechanics and skilled labour	46		96		142	
Boys	17		10		27	
Japanese	97		1		98	
Chinese	433		186		619	
Indians						
Totals	973		359		1,332	

Name of seams or pits—Comox mines.

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 4, 5, and 6 shafts and Nos. 4 and 7 slopes.

WELLINGTON-EXTENSION COLLIERY.

Thomas A. Spruston, Superintendent; James Strang, Manager, Nos. 1, 2, and 3 Mines.

The general supervision of this colliery is entrusted to Mr. Spruston, who has an overman in charge of each mine. These mines were formerly operated by the Wellington Colliery Company, but, like the Comox Colliery, were taken over by the Canadian Collieries (Dunsmuir), Limited, in 1910.

The Wellington-Extension Colliery, which is composed of Nos. 1, 2, and 3 mines, are situated in the Cranberry district, about six miles by road from Nanaimo and about eleven miles by

railway from Ladysmith. No. 5 mine is also in Cranberry district, at South Wellington, about nine miles from Ladysmith and five miles from Nanaimo. Coal is shipped from the Extension mines over eleven miles of railway to the shipping-wharves at Ladysmith. No. 5 mine shipments are made over the Esquimalt & Nanaimo Railway to the shipping-wharves at Ladysmith. All these mines have been working continuously throughout the year.

Nos. 1, 2, and 3 mines, situated at Extension, are connected by a tunnel driven 14 x 17 feet in the clear and one mile long, with a double track running practically the whole distance, and operated by Westinghouse electric locomotives. A wood flume 18 x 18 inches is laid parallel to the tracks for the whole length of the tunnel to take care of the water from each mine.

The new change and wash house which was built in the latter part of the year 1917 has given every satisfaction, being maintained up to the standard for the welfare of the men going and coming from their work. (For description of power-house equipment and plant at Extension *see* Minister of Mines' Report for 1917.)

A fully equipped rescue-station is kept and maintained in good condition at Extension, with smoke-room, observation-room, work-room, and dressing-room fitted with lockers, bath, and wash-basin. The equipment consists of four 2-hour sets of Draeger apparatus (1917 type), one oxygen-pump, four oxygen-tanks, four electric safety-lamps (Draeger type), and one pulmotor.

LADYSMITH.

During the year shipping and railway-car service has been steady. The coal-washery has been in continuous operation throughout the year, with the exception of about three weeks in August, when operations were retarded owing to a shortage of water from the mountain source, caused by the long-continued dry weather. A new boiler and pumping plant has been installed to take care of any water-shortage in the future.

No. 1 OR TUNNEL MINE, EXTENSION.

James Strang, Manager, Nos. 1, 2, and 3 Mines; William Wilson, Overman; John Greenhorn, William Clifford, David John Gordon, William Wesnedge, Albert Radford, and James Glen, Firebosses.

This mine is worked on the long-wall system, hand-mining being employed. During the year development-work in No. 3 slope has been greatly retarded owing to the broken and disturbed ground met with in the slope, and levels turned off the same. Water has also retarded the operations in this slope. A new 5-inch wood-pipe line and a 4-stage turbine-pump have been installed during the year to deal with the large supply of water met with in this slope.

No. 2 slope is operated by the same hoist that now operates both the Main and No. 3 slopes. This district is looking very promising, the coal averaging about 4 feet in thickness. This slope has not advanced any for several months, it being the intention of the management to develop this territory from No. 3 slope.

Safety-lamps of the Wolf type and the Edison storage-battery electric lamps are used throughout the mine, and all blasting is done with permitted explosives, fired by electric battery.

The mine is ventilated by a Murphy type exhaust-fan with a capacity of 45,000 cubic feet of air a minute, against a 1.7-inch water-gauge, driven by a 40-horse-power Allis-Chalmers-Bullock motor.

When I made my last inspection in December I measured 25,450 cubic feet of air a minute passing into the mine, divided into two splits.

In the East side split there was 10,500 cubic feet of air a minute passing for the use of thirty men and three mules, or an average of 269 cubic feet of air a minute for each unit employed.

In the West side split there was 7,500 cubic feet of air a minute passing for the use of fifteen men and two mules, or an average of 357 cubic feet of air a minute for each unit employed.

I found explosive gas on a cave and along the fault-line in No. 5 West level pillars, off No. 2 slope. The workmen were withdrawn from this section and the section securely fenced off pending the removal of the gas. I found timbering and roadways in good condition and the mine fairly free from coal-dust.

I made tests with the Burrell gas-detector in the splits and main return airways in this mine, with the following results: East side split showing 0.2 per cent. methane in 11,450 cubic feet of air a minute; West side split showing 0.3 per cent. methane in 8,750 cubic feet of air a minute; main return showing 0.6 per cent. methane in 30,500 cubic feet of air a minute.

No. 2 Mine, Extension.

Robert Leece Spruston, Overman; Owen Dabb, John Davidson, Joseph Mason, Joseph Watson, Robert N. Hamilton, and William Cosier, Firebosses.

During the year development-work has been carried out to a certain extent in No. 4 East district. The No. 1 incline has opened up a large area of pillar-work that has been abandoned since the labour troubles in 1912.

No. 17 incline has also been pushed ahead and opened up a promising section of long-wall work, the seam in this section averaging about 3 feet 9 inches in thickness. No. 3 dip slant is being driven with intention of opening up a large territory of solid coal to the dip side of this district.

In the Slope district a large amount of recovery-work has been done throughout the year, and some good coal has been taken out from the old abandoned workings in the several sections of the slope. No. 3 East level has been skipped where it has been heavily caved and cleaned up at other portions, which has improved the ventilation in this district and opened a large area of pillar-work.

Safety-lamps of the Wolf type and the Edison storage-battery electric lamp are used throughout the mine; all blasting is done with permitted explosives, fired by electric battery.

This mine is ventilated by a Murphy fan of 40,000 cubic feet capacity, against a 1.9-inch water-gauge, and is driven by a 25-horse-power type D.L.C. General Electric motor.

When I made my inspection in December I measured 31,100 cubic feet of air a minute passing into the mine, divided into three splits.

In the West side split there was 12,500 cubic feet of air a minute passing for the use of eight men and three mules, or an average of 462 cubic feet of air a minute for each unit employed.

In the East side split there was 5,400 cubic feet of air a minute passing for the use of seventeen men and two mules, or an average of 234 cubic feet of air a minute for each unit employed.

In No. 4 East split there was 13,200 cubic feet of air a minute passing for the use of twenty-eight men and six mules, or an average of 286 cubic feet of air a minute for each unit employed.

I found No. 2 mine free from explosive gas; timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in this mine are as follows: West side split showing 0.4 per cent. methane in 13,850 cubic feet of air a minute; East side split showing 0.3 per cent. methane in 6,000 cubic feet of air a minute; No. 4 East split showing 0.2 per cent. methane in 13,600 cubic feet of air a minute; main return showing 0.5 per cent. methane in 33,600 cubic feet of air a minute.

No. 3. Mine, Extension.

Thomas Strang, Overman; James Pollock Nommo, Jr., Patrick Malone, Daniel Campbell, David Davidson, George Smith, James Nelson, and Thomas Wilson, Firebosses.

Development-work in this mine during the year has been carried out principally in the No. 4 West Recovery district; levels and inclines having been driven through pillars and gobs, where some good coal has been recovered. The Main level will serve a double purpose in providing a new return airway from the Heading and McCoy's Incline districts and opening up a piece of solid coal which has been abandoned at a time when there was ample thick coal throughout the mine to work. Practically the whole of the mine is employed in pillar-extraction, with the exception of two levels off Malone's Dip section which are being driven in the solid.

Safety-lamps of the Wolf type and the Edison storage-battery electric lamp are used throughout the mine; all blasting is done with permitted explosives, fired by electric battery.

This mine is ventilated by a Guibal fan with a capacity of 65,000 cubic feet of air a minute, against a 1.7-inch water-gauge.

When I made my last inspection in December I measured 22,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 13,250 cubic feet of air a minute passing for the use of forty-five men and seven mules, or an average of 200 cubic feet of air a minute for each unit employed.

In No. 2 split there was 8,750 cubic feet of air a minute passing for use of twenty-four men and five mules, or an average of 221 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in the face of Quigley's level, off Malone's dip. (Place fenced off.) Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in the splits and main return were as follows: Return from No. 1 split showing 0.4 per cent. methane in 13,900 cubic feet of air a minute; return from No. 2 split showing 0.3 per cent. methane in 9,000 cubic feet of air a minute; main return showing 0.5 per cent. methane in 28,400 cubic feet of air a minute.

The following are the official returns from the Extension Collieries for the year ending December 31st, 1918:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	131,628			
" export to United States	25,570			
" " other countries				
Total sales		157,198		
Used in making coke	68			
Used under colliery boilers, etc.	15,041			
Lost in washing	49,644			
Total for colliery use		64,753		
Stocks on hand first of year	890			
" last of year	3,616			
Difference added to stock during year		2,726		
Output of collieries for year		224,677		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage
Supervision and clerical assistance	22		10		32	
Whites—Miners	198				198	
Miners' helpers	6				6	
Labourers	14		22		36	
Mechanics and skilled labour	102		56		158	
Boys						
Japanese						
Chinese	5		57		62	
Indians						
Totals	347		145		492	

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 1, 2, and 3 mines connected by main tunnel.

No. 5 MINE, SOUTH WELLINGTON.

Thomas A. Spruston, Manager; David Martin, Overman; Joseph Lane, Albert Warren Courtenay, and Daniel Coldwell, Firebosses.

This new mine is situated at South Wellington, about 700 yards south of the entrance to the Old Alexandria mine, and is operating in the Douglas seam. Good progress has been made on the underground development-work and the installation of the surface plant in connection with the operation of the mine.

The Main slope is down a distance of 2,500 feet, being driven 14 x 8 feet in the clear. The coal is well adapted for steam purposes and varies from 2 to 16 feet in thickness. It is worked on the pillar-and-stall method.

The levels on the South side of the slope have been in broken and disturbed ground up to the latter part of December, when 5 feet of good coal was struck in the Nos. 3 and 4 South levels.

The ventilation is produced by an 8-foot Stine fan, belt-driven by a 50-horse-power, tpye 3 Westinghouse motor, and is situated at the air-shaft, about 350 feet east of the Main slope. Heavy steel rails and switches are laid the full length of the slope. Safety-lamps of the Wolf type and the Edison storage-battery electric-lamps are used throughout the mine; blasting is done with permitted explosives, fired by electric battery.

The surface plant has been laid out on the most up-to-date methods for handling large quantities of coal with the least possible breakage. A marked feature is the compatible arrangements of the whole plant in close conjunction with the mine, water, and railway.

Railway connection has been made with the Esquimalt & Nanaimo Railway Company. The mine yard has been completed, together with empty and loaded sidings in connection with the Esquimalt & Nanaimo Railway. A main line runs throughout the yard with turnouts for full and empty cars under the tipple. A spur has been put in for loading box cars by special arrangements at the end of the picking-table and loading-boom. The tipple consists of a revolving dump, car-haul, shaker screens carrying two decks for the separate grades of coal, with suitable arrangements made for taking away boiler-fuel automatically when required. A loading-boom has been installed at the continuation of the picking-table, thus minimizing the breakage of the coal.

The power-house equipment consists of one 250-volt, d.c. Crocker-Wheeler generator of 112-kw. capacity, direct-coupled to a 15 x 14 Ideal engine; one Sullivan W.B. 2, size 22 x 24 x 14½, stroke 24 inches, air-pressure 90 lb.; one Ottuma 100-horse-power steam-driven hoist which operates the Main slope. Power is supplied by two Goldie & Bullock return-tubular boilers of 108.8 horse-power capacity each. Fuel is supplied from the fine screenings conveyed by a scraper conveyor direct from the shaker screens to the boiler-house. Other buildings consist of offices for manager and clerk and a suitable store-room, lamp-house, and mule-barn.

The water for the plant is obtained from the lake adjoining the colliery, and is pumped into a large Fairbanks tank with a capacity of 30,000 gallons, and stands at an elevation of about 50 feet.

When I made my last inspection in December I measured 56,000 cubic feet of air a minute passing into the mine for the use of thirty-two men and three mules, or an average of 14,000 cubic feet of air a minute for each unit employed. I found timbering and roadways in good condition and the mine free from explosive gas. The mine is free from coal-dust.

A test made with the Burrell gas-detector in the return airway showed 0.2 per cent. methane in 56,800 cubic feet of air a minute.

The following are the official returns from the South Wellington Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	20,889			
" export to United States				
" " other countries				
Total sales		20,889		
Lost in washing	6,901			
Used under colliery boilers, etc.	997			
Total for colliery use		7,898		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		28,787		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	4		4		8	
Whites—Miners	76				76	
Miners' helpers						
Labourers			8		8	
Mechanics and skilled labour	13		22		35	
Boys						
Japanese						
Chinese			20		20	
Indians						
Totals	93		54		147	

Description of seams, tunnels, levels, shafts, etc., and number of same—One slope located south of Old Alexander mine.

Granby Consolidated Mining, Smelting, and Power Co.

GRANBY No. 1 COLLIERY.

James Hargreaves, Manager; Thomas James Shaw, Henry Winstanley, and Alexander Derbyshire, Firebosses.

This mine is situated at Cassidy, B.C., and is being opened up on the Douglas seam, which averages 10 feet in thickness. Three parallel slopes are being driven on the pitch of the seam at an angle varying from 14 to 18 degrees. The manway is down 1,146 feet and is timbered with 12-inch framed sets, 4-foot centres, collars 6 feet between notches.

The Main slope is developed to a point 1,196 feet from the surface and is timbered with 12- to 14-inch framed sets, 4-foot centres, and 12 feet between notches. In the Parallel slope, or return airway, conections are made from the fan-shaft to No. 2 South level, a distance of 720 feet. This is being enlarged and is timbered with 12-inch framed sets, 4-foot centres, and 8 feet between notches. Four levels are off with parallel counter-levels.

Power-house.

The power-house equipment consists of the following units: One 500-kw. Allis-Chalmers-Bullock alternator, 2,300 volts, 3-phase, 60 cycles, running 360 r.p.m., and coupled direct to a vertical 2-cylinder compound condensing-engine.

One 250-kw. Allis-Chalmers-Bullock alternator, 2,300 volts, 3-phase, 60 cycles, running 450 r.p.m., direct-connected to a vertical 2-cylinder compound condensing-engine. These engines are equipped with C. W. Wheeler surface condensers.

One compound wound d.c. generator, 125 volts, capacity 200 amperes, running 625 r.p.m.; this is direct-coupled to a Goldie-McCulloch vertical single-cylinder high-speed engine.

One motor-driven generator. Motor, 220 volts, 3-phase, 60 cycles, 37½ horse-power; generator, 120 volts, d.c., 200 amperes, running 1,140 r.p.m.

A cross-compound condensing steam-driven Rand-Ingersoll compressor. Steam-cylinders, 16 and 28 inches by 24-inch stroke; air-cylinder, 15 and 25 inches diameter. This is connected with a Goldie-McCulloch jet condenser.

For fire-protection a Worthington duplex pump, 18 x 10 x 12 inches, has been installed; this pump has a capacity of 1,000 gallons a minute.

The water-supply is maintained by a twin set of Morris 4-stage centrifugal pumps, each driven by a 50-horse-power induction-motor. This water is delivered to two tanks, each having a capacity of 50,000 gallons.

The boiler-house equipment consists of two Badenhauser boilers, water-tube type, 260 horse-power each, and designed for 160 lb. pressure to the square inch. These are connected to a radial brick chimney 125 feet high. Forced draught is supplied by a Canadian Sirocco fan.

Twin Worthington simplex water-feed pumps supply the boilers from a Webster vacuum heater. Ashes are disposed of by a water-flush through a cement flume, extending into 10-inch glazed tile pipe.

The following buildings are constructed at Cassidy: Nineteen dwelling-houses, general office, mine office, rescue-station, mess-house, change-house, and lamp-house; a two-story rooming-house containing seventy-six rooms; each room is heated by steam and has hot- and cold-water connections; blacksmith-shop, machine-shop, and carpenter-shop.

Tipple.

The tipple has a capacity of 1,000 tons a day of eight hours. It consists of a revolving dump, Marcus screen, feeder for screen, chain-haul from ground-level, loading-boom, and car-retarder.

When I made my last inspection in December I measured 11,000 cubic feet of air a minute passing into the mine for the use of twenty-six men, or an average of 423 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in the face of No. 2 North level and No. 2 South level. Found timbering and roadways in good condition and the mine free from coal-dust.

I made a test with the Burrell gas-detector in the return airway of this mine, result showing nothing.

The following are the official returns from the Granby Colliery No. 1 for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	12,410			
" export to United States				
" " other countries				
Total sales		12,410		
Used in making coke				
" under colliery boilers, etc.	703			
Total for colliery use		703		
Stocks on hand first of year				
" last of year	3,845			
Difference added to stock during year		3,845		
Output of colliery for year		16,958		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance			7	6.50	7	6.50
Whites—Miners						
Miners' helpers	80	4.30	17	3.56	97	3.90
Labourers						
Mechanics and skilled labour						
Boys						
Japanese			1	3.10	1	3.10
Chinese			10	3.10	10	3.10
Indians						
Totals	80		35		115	

Name of seams or pits—Douglas seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Douglas seam, 10 feet thick. Three slopes: Main slope, 1,196 feet; Manway slope, 1,146 feet; Air slope, 820 feet from surface.

Description and length of tramway, plant, etc.—Plant and equipment all modern.

Telkwa Collieries Co., Ltd.

TELKWA COLLIERY.

The following are the official returns from the Telkwa Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	470			
" export to United States				
" " other countries				
Total sales		470		
Used in making coke				
Used under colliery boilers, etc.				
Total for colliery use				
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		470		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$				
Supervision and clerical assistance			1			
Whites—Miners	3	5.50				
Miners' helpers	1	5.00				
Labourers						
Mechanics and skilled labour						
Boys						
Japanese						
Chinese						
Indians						
Totals	4		1			

Name of seams or pits—Goat creek.

Description of seams, tunnels, levels, shafts, etc., and number of same—Two tunnels in side-hill.

Description and length of tramway, plant, etc.—*Nil.*

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT OF ROBERT STRACHAN, INSPECTOR.

I have the honour to submit my annual report as Inspector of Coal-mines for the Nicola-Princeton Inspection District during the year ending December 31st, 1918.

In the earlier part of the year this district was inspected from the Coast by Inspector Newton; in the latter part from this office by either Inspector Lancaster or myself.

The companies operating during the year were the Middlesboro Collieries, Limited, the Fleming Coal Company, the Princeton Coal and Land Company, and the Coalmont Collieries.

No active work was undertaken at either the Merritt Collieries, Limited (formerly the Diamond Vale Colliery Company, the Pacific Coast Collieries of British Columbia, the United Empire, or the Boundary Mining and Exploration Company, of Midway.

Two fatal accidents occurred during the year, both in the No. 3 mine, Coal Hill, belonging to the Fleming Coal Company, due to roof caving. Particulars of these and the other accidents have been sent to your office; as I have not investigated either, I cannot in any way determine the cause, but there is no doubt that stricter supervision and a more rigid enforcement of the special rules covering timbering and spragging of undermined coal would do a great deal to reduce these unfortunate occurrences.

During the year the inspection on behalf of the workmen, as required by section 91, Rule 37, of the "Coal-mines Regulation Act," has been carried out at No. 7, Middlesboro, but, so far, no such inspection has been made at the other mines. In this connection it should be considered that the other mines are small and the cost of such inspection would be heavy, and I should like to suggest that it would be in the interests of small mines if this rule was changed so that these could be grouped together for this purpose.

MINE-RESCUE WORK.

The standard in this work has been fairly well maintained during the year; quite a few took a course at the Princeton mine, and at the Middlesboro station the work was very well maintained. The importance of this work at some of the smaller mines does not seem yet to be realized, probably due to being out of touch, and I think the work of the Instructors appointed by the Department should be made elastic enough to reach these smaller mines.

The following is a brief description of the mines operating during the year 1918, accompanied by the official returns as required by section 58 of the "Coal-mines Regulation Act."

Middlesboro Collieries, Ltd.

Head Office—Vancouver, B.C.

Capital, $1,107,700.

Officers.	*Address.*
E. W. Hamber, President,	Vancouver, B.C.
G. S. Raphel, Vice-President,	Vancouver, B.C.
Thomas Sanderson, Managing Director and Secretary,	Vancouver, B.C.
C. M. O'Brian, Director and Treasurer,	Vancouver, B.C.
Robert Fairfoull, Mine Manager,	Middlesboro, B.C.

Value of plant, $250,000.

MIDDLESBORO COLLIERY.

Robert Fairfoull, Manager.

This colliery, consisting of Nos. 2, 4, 4 East, 7, 8, and 9 mines, is situated about a mile from the town of Merritt. A branch line of the Kettle Valley Railway about a mile long provides communication with the main line of the Canadian Pacific Railway and the Boundary country, to both points of which coal is shipped.

No. 4 Mine.

Alexander Ewart, Overman; William Hallinan, Geo. Hudson, Hugh Osborne, and Thos. Archibald, Firebosses.

This mine, which is reached by a rock tunnel crossing the measures, cuts Nos. 4, 5, 6, and 9 seams, and during the year the principal work has been confined to No. 4 seam, although some work was carried out on Nos. 6 and 9. No. 4 seam averages 18 feet; No. 6, 8 feet; No. 9, 7 feet; and they all lie at an angle of about 20 degrees, pitching to the south. The method of mining in all the seams is pillar and stall, pillars being left 30 x 60 feet, stalls being driven 10 feet wide. In the No. 4 seam the work during the year consisted of the extraction of pillars; in the other two seams, development-work.

The coal is mined by hand and very little blasting is needed; where required, permitted explosives are used and electric detonators. The haulage is by compressed air, the cars being hauled up the slopes by hoists, and taken from there to the tipple by a main- and tail-rope arrangement.

Ventilation is provided by a Sheldon type fan, 8.5 feet diameter, driven by a steam-engine, and can be used either as an exhaust or positive type. The general condition as to ventilation is very good, and very seldom is explosive gas found, while the mine is fairly free from coal-dust.

During the past two years trouble has been experienced with a gob-fire in the No. 4 seam; this has been stopped off and so far no attempt has been made to reopen it.

At my last inspection in December I found 44,800 cubic feet of air a minute for the use of eighteen men and three horses, with the fan running at a speed of 90 revolutions a minute. The working-places and roadways are all very well timbered and a plentiful supply of timber is provided for the use of the workmen.

No. 4 East Mine.

James Fairfoull, Overman; M. McKibben and Lewis Shearer, Firebosses.

This mine is situated a short distance to the east of the entrance to No. 4, and is also on the No. 4 seam. The Main slope is down a distance of about 1,300 feet; the pitch method of work and the haulage arrangements are very similar to those in No. 4 mine. Considerable trouble has been experienced with faulting in this mine, and most of the work is of a prospecting nature.

The ventilation is produced by a small quick-running fan, 4 feet diameter, driven by a Sheldon steam-engine, and at the time of my last inspection was producing 32,000 cubic feet of air a minute for the use of ten men, running at 330 revolutions a minute, and a water-gauge of 0.5 inch.

The mine was very well timbered and plenty of timber seemed to be provided convenient for the use of the workmen. Generally the mining conditions are very good and the mine is free from dangerous coal-dust, while explosive gas is very seldom found.

No. 7. Mine.

Jno. McDonald, Overman; Thos. Rowbottom, Jas. McGrath, Howell John, and Jonathan Henney, Firebosses.

This mine is situated in Coal gully and about 400 feet higher than the entrance to the No. 4 mine, and is now down about 3,000 feet. The seam, which is generally considered the same as the No. 4, is about 15 feet thick, of which only the top 8 feet has been extracted in the operation of development. The method of work is similar to that already described, but the size of the pillars has been increased with the depth of the slope or the amount of overhead strata.

For the present, the intentions are to begin the extraction of pillars and gradually to retreat; the coal below the present level will be extracted through the No. 4 mine at some future date.

Ventilation is produced by a small fan of the Guibal type, driven by a compressed-air engine, and at the time of my last inspection was producing 35,000 cubic feet of air a minute for the use of twenty-four men and one horse. The speed of the fan was 200 revolutions a minute, and it showed a pressure of 0.3-inch water-gauge.

I found no traces of explosive gas and generally the mine was very well ventilated. All the places and roadways are very well timbered and plenty of timber is provided convenient for the workmen.

The cars are hoisted by compressed air to the surface, and then lowered to the tipple by a gravity-plane. Nos. 8 and 9 are as yet in the prospecting stage, but will soon be connected to the other mines.

While no fan is in use at either place, I found no trace of gas and, due to natural ventilation, there was a fair current of air travelling around the faces.

As mentioned in the case of No. 4, blasting is in practice at all the mines under the charge of competent officials, permitted explosives only being used with electric detonators.

All the lamps in use inside the mine are either Edison electric mine-lamp or of the Wolf type, and these are cleaned and recharged at the lamp-room near the tipple before being given out to the workmen, and are again examined by the fireboss before entering the mine.

All the coal is brought to a common tipple in cars having a capacity of about 1.75 tons. The dump is of the Phillips crossover style, a switchback and car-haul taking the cars back, so that they can be arranged into trips for whatever place required. After being dumped the lump coal passes over the screens to the coal-pocket, and slack to a hopper, where it is then sized for market purposes.

The main power plant is situated near the tipple, consisting of four return tubular boilers, each 160 horse-power; a Canadian Rand cross-compound air-compressor with a capacity of 2,000 cubic feet a minute provides power for operating the hoists and pumps and a generator for lighting purposes. There are also well-equipped machine, carpenter, and car-repair shops, also a commodious office for the management.

Copies of the "Coal-mines Regulation Act," special rules, and rules covering "systematic timbering" and plans of the mine are all kept posted at the mine entrances.

A well-equipped mine-rescue training-station is also maintained here, in which is maintained, in addition to the company's mine-rescue apparatus, that belonging to the Department of Mines, both of which are kept in a high state of efficiency. A great deal of credit is due the management for the interest taken in the work, which is reflected in the number of men who have been trained not only for the use of Middlesboro Colliery, but for the general use of the district.

The following are the official returns of the Middlesboro Colliery for the year ending December 31st, 1918:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	95,781			
" export to United States				
" " other countries				
Total sales		95,781		
Used in making coke				
" under colliery boilers, etc.	5,747			
Total for colliery use		5,747		
Stocks on hand first of year	125			
" last of year	156			
Difference added to stock during year		31		
Output of colliery for year		101,559		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
				$		
Supervision and clerical assistance	13	.....	5	.....	18	.....
Whites—Miners	42	.....	.....	6.75	42	.....
Miners' helpers	18	.....	.....	4.30	18	.....
Labourers	46	.....	16	4.20	62	.....
Mechanics and skilled labour	.....	.....	15	6.00	15	.....
Boys	.....	.....	13	2.65	13	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	119	.....	49	.....	168	.....

Name of seams or pits—No. 4 seam, operated by No. 4 East mine, No. 4 mine, and No. 7 mine; No. 8 seam, in which is operated No. 8 mine; No. 6 seam by No. 6 mine.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 4 mine is operated by a tunnel passing through a portion of No. 5 seam; then crosscut from No. 5 to No. 4; thence to No. 8 and No. 6 seams. No. 4 East: This mine is operated by means of a slope driven east, the distance from entrance to face being 1,600 feet, average dip being 15 degrees. No. 7 mine: The coal from this mine is hauled from a slope dipping 20 degrees south. The distance from the entrance to the face of the slope is 2,800 feet. The only method of working throughout is room and pillar. Thickness of No. 4 seam, from 10 to 18 feet; No. 6 is 5½ feet thick and No. 8 is 6 to 8 feet in thickness.

Description and length of tramway, plant, etc.—The power plant is situated at the tipple, and consists of four return-tubular boilers, each 150 horse-power; one Ideal feed-water heater, rated capacity, 500 horse-power; Canadian Rand cross-compound air-compressor, 2,215 cubic feet of free air a minute. A 27½-kw. generator is used for lighting purposes. The water for household, fire-protection, and steam-raising is supplied by a pump-station, the wells of which are situated near the Coldwater river.

The Fleming Coal Company, Ltd.

(Formerly the Inland Coal and Coke Company, Ltd.)

Head Office—Vancouver, B.C.

Officers.	*Address.*
Joseph Martin, President,	Vancouver, B.C.
Joseph Graham, Managing Director,	Merritt, B.C.
Joseph Martin, Secretary-Treasurer,	Vancouver, B.C.
A. E. Smith, Manager,	Merritt, B.C.

COAL CREEK COLLIERY.

This colliery is situated south-west of the Middlesboro and at an elevation of 500 feet above it.

No. 3 Mine.

John Brown, Overman; John Smith and Geo. Maxwell, Firebosses.

This mine, the only one operating during the year, consists of Nos. 3 and 5 seams, the first being about 12 feet and the other 5.5 feet thick, and identified with the Nos. 4 and 8 seams, Middlesboro. The methods of work are pillar and stall, but during the year the work has

consisted of extracting pillars in No. 3 seam, while both extraction of pillars and development-work has been carried on in the No. 5 seam.

The ventilation is produced by a fan of the Sheldon type, driven by a steam-engine, and producing about 30,000 cubic feet of air a minute, running at a speed of 300 revolutions a minute and a 0.5-inch water-gauge. At the time of the last inspection it was producing 30,000 cubic feet for the use of twenty-three men and two horses.

Conditions in the No. 3 seam were faily good, but considerable improvement is required in the ventilation in the No. 5 seam, and some method of treating the coal-dust there is very necessary. The general conditions, apart from the above, are fairly good, the roadways and faces are fairly well timbered, and a plentiful supply of timber is provided convenient for the workmen.

The work in the No. 3 seam was greatly curtailed some years ago owing to a mine fire, but seems fairly well under control, and indications are that a great amount of this coal will be recovered.

The coal is all mined by hand, and blasted with Monobel with electric detonators under the supervision of certificated shotfirers. The haulage is by horse from bottom of chutes to the slope; then steam-hoist to surface; from here they are lowered to the top of a gravity-plane by another hoist. The gravity-tram consists of a 3-railed track, with passing in the middle 1,800 feet long, handling six 1-ton cars to the trip, using a 1-inch steel rope on a Stine wheel.

Safety-lamps of the Wolf type are used mainly; a few electric of the Edison type are used on haulage; all the lamps are cleaned and examined at the lamp-room, and are re-examined before being allowed to enter the mine.

The power plant at the mine consists of two Leonard type boilers, each 40 horse-power, which furnish steam for the fan, hoists, pumps, lighting, engine, and wash-house. An auxiliary plant at the tipple consists of a 25-horse-power boiler which furnishes steam for a small hoist which hauls the cars on the tipple, and for the pump used to deliver the water from the Coldwater river to the mine plant. The other surface equipment consists of machine, carpenter, and car-repair shops and office buildings. The tipple is connected to the Kettle Valley Railway by a spur about a mile long, affording access to the main line of the Canadian Pacific Railway.

The following are the official returns of the Fleming Coal Company for the year ending December 31st, 1918:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	31,414			
" export to United States				
" " other countries				
Total sales		31,414		
Used in making coke				
Used under colliery boilers, etc.	1,659			
Total for colliery use		1,659		
Stocks on hand first of year				
" last of year	130			
Difference added to stock during year		130		
Output of colliery for year		33,203		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	5	6.00	2	5.00	7	
Whites—Miners	35	7.00			35	
Miners' helpers						
Labourers	14	4.25	10	4.00	24	
Mechanics and skilled labour			7	5.00	7	
Boys						
Japanese						
Chinese						
Indians						
Totals	54		19		73	

Name of seams or pits—Operated Nos. 3 and 5 seams.

Description of seams, tunnels, levels, shafts, etc., and number of same—Five seams have been opened on the property, consisting of No. 1, 3 feet thick, on which a slope 300 feet deep has been driven; No. 2 seam, 7½ feet thick, connected with No. 1 with a shaft and opened up on the pitch with a slope 500 feet deep. No. 3 is an average of 10 feet thick and has been operated extensively for seven years, though shut down the greater part of 1917 owing to low prices for coal paid by the railways. The operation during the year on this seam was chiefly confined to the extraction of pillars, which was quite successful, as the sandstone roof breaks clean, giving ample warning. The No. 4 seam has only been exposed on the surface. No. 5 seam was operated in conjunction with No. 3, and considerable development carried on, showing that it improves with depth; at the 600-foot level it is over 6 feet thick.

Description and length of tramway, plant, etc.—There has been no addition to the plant, but it has been altered to give better results and is well maintained. The main boiler plant consists of 240-horse-power Eclipse type Leonard boiler. The fan is an Aleos type, capacity of 50,000 cubic feet, belt-driven by a 60-horse-power engine. The winding-engine is a 60-horse-power Ottuma engine, and there is an 18-horse-power Beatty engine on the haul back from the tramway. The tramway is 1,800 feet long on a 40-degree slope and three rails, with Stine head-gear, handling 6-car trips of 1 ton each capacity. The water used is obtained from the Coldwater river, pumped against a 600-foot head by a Marsh pump.

Princeton Coal and Land Company, Ltd.

Head Office—15 Great St. Helens, London, E.C.

Capital, $1,000,000.

Officers.	*Address.*
A. St. George Hamersley, Chairman,	London, Eng.
E. S. Neave, Secretary,	London, Eng.
Ernest Waterman, General Manager,	Princeton, B.C.
Francis Glover, Manager,	Princeton, B.C.

Value of plant, $77,000.

PRINCETON COLLIERY.

Francis Glover, Manager; Andrew McKendrick, Overman; Robert Baxter, Robt. Gourlay, Ben. J. Barlow, and Robert Roughead, Firebosses.

This company's property is situated near the town of Princeton, on the right-hand side of the Similkameen river, near its junction with the Tulameen, and is in the Similkameen Mining Division.

This mine, the only one at present working, reaches the coal through a covering of gravel, the slope dipping about 14 degrees until it reaches the coal; then continues on the seam for about 2,500 feet on a pitch of about 12 degrees. The coal-seam is about 20 feet thick, of which only the top 10 feet is extracted, and is worked on the pillar-and-stall method, pillars being left about 50 feet square; stalls are driven 12 feet wide.

Unfortunately in the early stages of mining here very little attention was paid to any system, with the result that slack coal and machine minings were left indiscriminately, resulting in mine fires which have been a constant source of trouble ever since. This last few years the mining has been done by the panel system, only two openings leading into the panel, so that when the coal inside was extracted the panel could be sealed off. Under this system no trouble has been experienced with fire in the newer working, but in the older, owing to the slight cover, it has been found almost impossible to extinguish the fires.

The haulage is by small air-hoists which feed the Main slope, an outside steam-hoist hauling to the tipple. The ventilation is by a small fan of the Guibal type, driven by a steam-engine, and at the time of my last inspection was producing 25,200 cubic feet of air a minute for the use of thirty men. The speed of the fan was 130 revolutions a minute and the water-gauge showed 0.5 inch.

I found no trace of explosive gas and on the West side the air-current was very slack. All the places and roadways were very well timbered and a plentiful supply of timber was provided for the use of the workmen.

The coal is all mined with machines of the post-puncher type, air-driven, and is blasted down with permitted explosives, electric detonators being used under the supervision of certificated shotlighters. All the machine minings are loaded out of the mine and a sprinkling system is in use to keep the dust down.

The surface equipment consists of a tipple with a link-belt screening plant having a capacity of about 400 tons a day. The coal is loaded into a car holding about 1.5 tons, and is hauled up the Main slope in trips of six cars by a 50-horse-power steam-hoist to the tipple. A Robison self-acting rotary dump unloads them on to a picking and shaking screen, which sizes the coal into three grades for the market. The tipple machinery is driven by a 50-horse-power vertical steam-engine, while the loading-conveyor is driven by a separate engine.

The power plant consists of three boilers—two 75-horse-power return-tubular and one 50-horse-power Gray boiler. Two Canadian Rand air-compressors furnish power for the mining-machines, pumps, and inside hoists, and a 60-kw. 3-phase alternating-current dynamo furnishes light for the mines and the town of Princeton.

A well equipped machine, carpenter, and car-repair shop, in addition to the lamp-room, provides surface accommodation. During the past year the wash-house was burned down and a new one is in course of erection.

Electric lamps of the Wico type and Wolf safety-lamps are used, and are cleaned and repaired at the lamp-room before being issued, and are again re-examined before entering the mine.

Copies of the "Coal-mines Regulation Act," special rules, "timbering order," and plans of the mine are posted at the mine entrance.

The following are the official returns of the Princeton Coal and Land Company for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	20,494			
" export to United States	10,518			
" " other countries				
Total sales		31,012		
Lost in washing	1,564			
Used under colliery boilers, etc.	6,161			
Total for colliery use		7,725		
		38,737		
Stocks on hand first of year	149			
" last of year	85			
Difference taken from stock during year		64		
Output of colliery for year		38,673		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance			5	5.50	5	
Whites—Miners	14	5.00 - 9.00			14	
Miners' helpers	10	4.45 - 5.00			10	
Labourers	20	4.00 - 5.00	7	4.00	27	
Mechanics and skilled labour			7	4.40 - 4.65	7	
Boys			4	2.00 - 2.75	4	
Japanese						
Chinese						
Indians						
Totals	44		23		67	

Name of seams or pits—As last year.

Description of seams, tunnels, levels, shafts, etc., and number of same—Practically as last year.

Description and length of tramway, plant, etc.—Practically as last year.

Coalmont Collieries, Limited.

Head Office—Vancouver, B.C.

Capital, $3,000,000.

Officers.	*Address.*
W. J. Blake-Wilson, President,	Vancouver, B.C.
W. L. Parrish, Vice-President,	Winnipeg, Man.
A. H. Douglas, Secretary-Treasurer,	Vancouver, B.C.
Donald McLean, Manager,	Coalmont, B.C.

COALMONT COLLIERY.

Donald McLean, Manager; Thos. Bysouth, Fireboss.

This colliery is situated in the Similkameen Mining Division, about five miles from the town of Coalmont, on the North fork of Granite creek. After having been stopped for about two years work was resumed this spring, a raise having been put through to the surface to facilitate ventilation; the level in the No. 2 tunnel was pushed ahead and several pillars blocked out. Only a few men have been employed and the work is more of a prospecting nature to determine the quality and quantity of coal.

The ventilation, which is produced by a 36-inch Comstock blower, driven by an 8- x 10-inch steam-engine, driven at a speed of 600 revolutions a minute, was very good and showed 8,000 cubic feet a minute for the use of five men. The general conditions were very good and the mine well timbered.

In the No. 6 tunnel very little work has been done so far, and this consists mostly of rock-work. The coal which has been mined during the year had to be hauled by auto-trucks to the Kettle Valley Railway at Coalmont, a distance of almost five miles.

A small 25-horse-power boiler supplies steam for the fan, and a cook and bunk house is maintained at the mine, the principal workshops and offices being at Coalmont.

Open lights are used, but the inspection is made with a Wolf safety-lamp, and, so far, no gas has been reported. Copies of the "Coal-mines Regulation Act," special rules, and plans of the mine are kept posted at the mine entrance.

The following are the official returns of the Coalmont Collieries for the year ending December 31st, 1918:—

Sales and Output for the Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	2,990			
" export to United States	1,454			
" " other countries				
Total sales		4,444		
Used in making coke				
Used under colliery boilers, etc.	300			
Total for colliery use		300		
Stocks on hand first of year				
" last of year	1,000			
Difference added to stock during year		1,000		
Output of colliery for year		5,744		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	2		2		4	
Whites—Miners	8	4.55-7.00			8	
Miners' helpers	2	4.50			2	
Labourers	2	4.00	2	4.00	4	
Mechanics and skilled labour			2	5.00	2	
Boys						
Japanese						
Chinese						
Indians						
Totals	14		6		20	

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 1 tunnel: Work closed till further development of No. 2 tunnel; 800 feet of tram-line, all in rock. No. 2 tunnel driven along the strike of upper seam, N. 29° 50′ W.; 2,700 feet of tram-line. Seam about 60 feet thick. Part of seam being worked averages 9 feet in thickness. Possible output at present 200 tons a day of eight hours. Transport from mine to railway-cars difficult.

Description and length of tramway, plant, etc.—No. 1 tunnel, 800 feet tram-line; No. 2 tunnel, 2,700 feet tram-line. Two 50-horse-power boilers; one 22.5-horse-power boiler; one compressor, 150 lb. pressure; three steam-engines; two small fans, etc.

EAST KOOTENAY INSPECTION DISTRICT.

Report of Robert Strachan, Senior, Inspector.

I have the honour to submit the annual report of the coal-mines operating in the Crowsnest Pass Inspection District during the year 1918.

These consisted of Coal Creek Colliery of seven mines—the Michel Colliery with three mines, which are owned by the Crow's Nest Pass Coal Company, Limited, of Toronto, and four mines (including the open-cut) at Corbin Colliery, owned by the Corbin Coal and Coke Company, of Spokane, U.S.A.

No attempt was made to reopen either the Carbonado Colliery, of the Crow's Nest Pass Coal Company, Limited, at Morrissey, which was shut down in 1909, or the Hosmer mines, belonging to the Canadian Pacific Railway Natural Resources Department, closed in 1914.

With the exception of a five-weeks' stoppage, affecting Coal Creek and Michel mines, caused by a dispute regarding the working of a single shift in the mines instead of a double shift, work has been fairly steady during the year, although in the latter part an epidemic of sickness very materially affected the attendance at the mines, and consequently a reduction in the output of coal.

The dispute *re* the single shift was settled by the Director of Coal-mines appointed by the Dominion Government directing the workmen to resume the production of coal, and the Minister of Mines of the British Columbia Government to appoint a Commission consisting of one party appointed by the workmen, one by the owners, and one by the Minister of Mines, which was to inquire into the conditions complained of by the men, and to report, when the order directing the men to resume work would be subject to revision; so far the Commission has not been appointed, owing, I believe, to the workmen having refused to nominate a representative.

The gross output of this district for the year amounts to 732,864 long tons, and shows an increase of about 180,000 tons over the previous year.

ACCIDENTS.

During the year fifteen accidents have been reported, five of which were fatal and ten serious. Of the fatal accidents, two occurred at Coal Creek, in No. 1 South mine, and three at Michel, two of which occurred in No. 8 mine and one in No. 3.

The causes were: In Coal Creek, falls of coal, in one case off the rib or side, the other a cave of roof coal and rock; in Michel, two were due to haulage, the first owing to the compressed-air locomotive jumping off the track, the other owing to lack of space between the side of the road and a piece of machinery which was being moved; and the third accident through the workmen allowing a stringer to fall while placing it in position, striking the fireboss in charge of the work with fatal results.

In the serious or non-fatal class we have five accidents due to haulage, four to falls of roof rock or coal, and one to falling down a chute. All of these accidents have been investigated, and leaves no doubt that the majority are in the avoidable class. Stricter observance of the "Systematic Timbering" orders as laid down in the special rules, and these applied to repair-work, should be impressed on workmen and officials alike, as we frequently find, when visiting the mines, a tendency to neglect both the spragging of the undermined coal and to exceed the maximum distance the timbers should be apart.

While the list of fatalities is very much smaller than last year, we cannot overlook the fact that we have had more accidents with fatal results. In 1917 two accidents contributed thirty-five fatalities; one, the explosion in No. 3 mine, Coal Creek, being responsible for thirty-four of these, showing that the small accidents have contributed more deaths, and indicating that stricter discipline is required to prevent these. As I mentioned in my report last year, the recovery-work in No. 3 East mine, Michel, where the explosion took place on August 8th, 1916, was still proceeding, and on February 26th, 1918, the body of Bratticeman Marmol was recovered in No. 13 room, No. 6 East level, and thus settles the difference as to where he was at the time of the explosion.

My report to you following the recovery of this body gives my reasons for believing that this explosion originated in No. 17 room, No. 6 East level, and the cause an ignition of gas at a defective lamp, the coal-dust on the roadways and sides propagating it throughout the mine.

In No. 3, Coal Creek, where the explosion occurred on April 5th, 1917, the work of recovery was steadily pursued and the remaining six bodies recovered. The first of these was F. Puillandre on February 26th, and the following day his working partner, A. Redoulez, both of whom worked in the Main level. The two bodies were found not far apart on the Main level, about 800 feet outby from their place, as if on their way out of the mine when the explosion occurred.

On June 13th, 1918, the bodies of William Brown and Joe Bravin were found in their working-place in the counter-level, also those of Hector and August Leonard in the crosscut between the Main and counter levels. A Wolf safety-lamp with a punctured hole in the glass cylinder found in the last place provides the principal clue as to the cause of this disaster.

The principal roadways in this mine have now been repaired and work resumed; large developments are in course of being carried out to provide for increased ventilation.

As outlined last year, methods of treating the coal-dust, the principal source of propagating an explosion after ignition, have been continued and in nearly every case brought to completion. The conditions in this respect are very much improved; not only are the roadways treated with water, flue-dust, and ashes, but the roof, sides, and the working-faces are treated thoroughly with water every twenty-four hours, and in some cases more frequently. In some of the mines sprays are arranged to keep the mine-air thoroughly saturated, thus tending to prevent dust rising from the loaded cars in transit.

I should like to see a more extended use of sprays, so arranged to treat the loaded cars before they start on their outward journey. No effort, I feel, should be spared in these mines to keep every part of the intake, haulage, or other roads thoroughly damp, as well as the working-faces, for without doubt the greatest amount of damage in any explosion is caused by coal-dust.

The general condition as to ventilation in the mine has been fairly good during the year, and with the projected installation of a new fan should be even better in 1919. Samples of mine-air were taken regularly during the year, in the most gassy mines nearly every month, and sent to the Department of Mines, Ottawa, for analysis, and have been of very great assistance to us in maintaining our adopted standard of ventilation. Two hundred and eighty-eight samples were taken in Coal Creek, 104 in Michel, and nine in Corbin. Of these, thirty-three were lost,

due either to accident in laboratory or in transit, or about 8 per cent. of the total. In addition to the samples taken in the regular air-current, which in the case of the splits were taken convenient to the last working-place, or of the main return at the junction of the splits, a great number were taken to determine the outflow of methane from the working-faces over certain periods while working or idle, and also from gas-feeders and mine fires. In this work of sampling we are very much indebted to the mine officials for their willing assistance; without this it would have been impossible to have obtained the results.

In the No. 3 mine, Coal Creek, two series were taken during the working-hours, samples being taken every half-hour for six hours. The first series, taken on June 1st, 1918, commencing at 9.30 a.m., showed 0.79 per cent. of methane, rising steady to 1.3 per cent. about half-past 1 and falling to 1.23 at 3.30 p.m., the quantity of air travelling in this split (No. 6 incline) being 31,800 cubic feet a minute.

The second series, taken on June 6th in the same district and with practically the same quantity of air, commencing at the same time, showed pretty nearly similar results, commencing with 0.75 per cent. methane, rising to 1.29 at 2 p.m., and falling to 1.26 at 2.30 p.m.; unfortunately the last results were lost, but sufficient information was derived to show that the production of methane increases and decreases directly as the work of breaking down coal increases and decreases. The decrease showing from 2 p.m. onwards indicates that the miner is devoting more time to either loading or timbering than to actual breaking-down of coal.

In No. 1 East mine, Coal Creek, a series of tests were made also; the first on April 20th, made in the South split, consisted of seven samples, one being taken every hour, commencing at 9 a.m., and showed 2.1 per cent. methane and rising steady to 2.37 at 3.15 p.m., with a quantity of 35,000 cubic feet a minute.

A second series, taken on April 26th in the same district of this mine, with the same quantity of air, consisted of twelve samples, one being taken every two hours, commencing at 9 a.m., and showed 2.02 per cent. methane, rising to 2.29 at 1 p.m. and falling to 2.08 at 7 a.m. the following morning, when the tests finished. This covers the twenty-four hours during which the mine worked actively, producing coal from 7 a.m. to 3 p.m.; then a period of rest to 7 p.m., resuming active mining at 7 p.m., continuing to 3 a.m.; then a further period of rest till 7 a.m.

A similar test made in No. 1 South mine, Coal Creek, on April 26th, consisted of testing the air-current every hour for six hours, commencing at 9 a.m., and showed 1.81 per cent. methane, rising to 2.12 at 2.30 p.m. and falling to 1.74 at 3.30 p.m., in an air-current of 35,000 cubic feet a minute, or practically the same conditions as found in No. 3 mine.

In the South split, No. 1 East mine, Coal Creek, sample while working showed 2.34 per cent. methane (last sample taken before stoppage); after being idle forty-five hours showed 1.82 per cent.; idle 115 hours, 1.64 per cent.; nine days, 1.52; twenty-eight days idle, 1.5 per cent., with an air quantity of 31,500 cubic feet a minute.

A similar series of tests made in No. 1 South mine, Coal Creek, showed while working 2.44 per cent. methane (last sample taken before stoppage of work), decreased to 1.43 per cent. after fifteen days idle, and three days after resuming work analysis only showed 1.41 per cent. Since the resumption of work after the idle time it has been very hard to get a fair test made of the outflow under the single-shift conditions owing to irregularity of the work caused by the epidemic of sickness. One thing I have noticed is that in no case so far has it reached the height shown under the double-shift conditions.

Twice during the year has ethane been reported as found in the analysis, both cases being in the High Line split of No. 2 mine, Coal Creek, sample No. 308 showing 0.13 per cent. and sample No. 396 a trace. This seems strange when we consider that this split has very seldom shown more than 0.7 per cent. methane, while in some cases of blow-out we have recorded 84 per cent. of methane and no trace of ethane.

In the Michel mines tests made during the time the mines were idle showed results much similar to Coal Creek, except in one case, where owing to the speed of the fan being decreased the methane curve shows a tendency upwards. Owing to this we were unable to make so many tests in Michel mines, and the reason more tests were made in one mine than another is due to the tendency of these to give off greater amounts of methane.

The conditions of the airways have been improved to some extent during the year, but a great deal of work still remains to make them all satisfactory, also to cope with the previously

mentioned projected installation of new fans, or, better still, duplicate airways to reduce the high velocities.

Another point I should like to bring up is the provision of separate travelling-roads for the workmen, and where high velocities of air are maintained these are almost indispensable in districts where the temperature during winter falls below zero.

No severe "bumps" have been felt during the year, although several small disturbances have been reported, in some cases resulting in caves at the working-face liberating large quantities of methane, causing the workmen to leave the mine. In this respect the report of George Rice on the "bumps" has been at the disposal of the mine officials for almost a year, but so far no steps have been taken to adopt either the suggestions by him *re* timbering or the alternative one put forward by the Coal Company. Regarding these small disturbances or "bumps," as they are called locally, a great many of these could be easily avoided, provided heavier timber was used and more care taken to secure it.

Several blow-outs of gas have been reported, the largest of which took place in January in No. 26 room, off No. 10 East entry, No. 1 East, Coal Creek, about midnight, displacing 45 tons of coal and leaving a cavity ahead of the working-face about 16 feet deep, 8 feet high, and 9 feet wide. Fortunately, as in the blow-out reported last year, sufficient warning was given to allow the workmen to escape.

In dealing with these blow-outs or "bumps," the greatest danger now that electric lamps are in use is the likelihood of the workmen getting overcome by gas and asphyxiated, and I should like to suggest that investigation be made along the lines of either solving the problems or providing mine-safety apparatus for each individual workman employed in suspected areas.

Mine Fires.

Trouble with mine fires has been experienced during the year at Corbin and Coal Creek. In the first place, the fire reported last year spread to a lower level, but was successfully sealed off in October. The spread of this fire would seem to indicate that in large coal-seams it is almost impossible to seal fires off successfully with stoppings, and if the fire cannot be loaded or drowned out some method of filling in the areas left vacant by the extraction of coal with sand, clay, or non-cumbustible matter should be adopted.

In No. 1 South mine, Coal Creek, an outbreak of fire was reported in No. 8 room, off No. 4 incline, early in November. Fortunately a good supply of water was convenient to keep it from spreading and work was commenced to load it out, which was successfully accomplished about December 17th.

In investigating mine fires, which seem to be on the increase, the principal cause is lack of sufficient ventilation; old districts are abandoned and not properly sealed off, sluggish currents of air travelling through them, decaying timbers, crushing of pillars, causing decrepitation of the coal, furnish the most favourable conditions for spontaneous combustion.

Practically all the lamps in use by the workmen are the Edison electric mine safety-lamp, the exception being the officials, who use the Wolf safety-lamp in addition to the Burrell gas-detector for inspection purposes.

Searches of the workmen for matches and other articles contrary to Rule 9, section 91, of the "Coal-mines Regulation Act" have been made regularly during the year at all the mines, and in only one case was such found, when the party was prosecuted. Inspection on behalf of the workmen was made nearly every month and copies of the report sent to your office, but no report of the existence or apprehended existence of dangerous conditions was made to this office.

Blasting was carried out to a very limited extent at Coal Creek; in two places in No. B, but to a greater extent at Michel and Corbin. This is carried out as required by the "Mines Act," and so far we have had no cause to complain of the conditions under which this was carried out.

The explosives used amounted to 6,525 lb. Monobel, 18,792 lb. Permitite, 203 lb. Samsonite, and 2,597 lb. Giant; the last two being used for outside purposes or at the open-cut at Corbin.

In Coal Creek 1,956 lb. Permitite was used in 2,050 shots, allowing 0.95 lb. a shot; all the shots being fired with battery and no miss-fires reported.

In Michel 7,511 lb. Permitite was used in 6,406 shots, allowing 1.1 lb. a shot; 3,200 of these were fired with battery, the remainder by fuse; 4,406 lb. Monobel was used in 4,000 shots, allowing 1.1 lb. a shot, and 203 lb. of Samsonite for 306 shots, allowing 0.66 lb. a shot. No miss-fires were reported from Michel.

At Corbin 2,119 lb. Monobel was used and 2,597 lb. Giant for 2,228 shots by electric detonator and 446 by fuse.

The amount of mine-rescue apparatus maintained at the mines is similar to last year and is all of the Draeger type, either 2-hour or ½-hour capacity. The lack of interest in maintaining efficiency in the use of this still continues, and, although a mine-rescue training-station is maintained here at Fernie, not a single workman took a course during the year, nor did any of the present holders of certificates renew their training. This lack of interest is to a great extent due to the expense incurred, especially by the workmen from Michel and Corbin, and also to the fact that, although called upon in the event of an emergency, there is very little and generally inadequate compensation for the work.

In this respect I should like to point out that it would be of great value if a minimum amount of apparatus was set out in the Act; also a minimum amount of training and the amount of work necessary to maintain efficiency; also provision for requiring the turning-out of mine-rescue brigades to test the efficiency, in the same manner as fire brigades are required to do, then we would have some idea of what to expect in the event of a disaster.

The work of first aid to the injured has been very well maintained at all the mines; a demonstration of this was given in Fernie on Labour Day, when four teams turned out from Fernie, Coal Creek, and Michel in competition. In addition to this, a junior team in this work carried off first place at an open competition in Lethbridge, Alberta, on Dominion Day against all-comers, reflecting great credit on the team and their instructors.

In conclusion, I wish to thank the mine officials for their assistance in carrying out my duties during the year, and trust for a continuation of the same during the coming year, so that we may work together for greater safety in what is admittedly dangerous work.

Attached is a list of the accidents reported, prosecutions, and a brief description of the collieries.

Crow's Nest Pass Coal Company, Ltd.

Capital, $3,500,000.

Officers.	*Address.*
Elias Rogers, President,	Toronto, Ont.
E. C. Whitney, Vice-President,	Ottawa, Ont.
R. M. Young, Secretary,	Fernie, B.C.
Elias Rogers, Treasurer,	Toronto, Ont.
W. R. Wilson, General Manager,	Fernie, B.C.
Bernard Caufield, Colliery Manager, Coal Creek Collieries,	Fernie, B.C.
Thomas H. Williams, Colliery Manager, Michel Collieries,	Michel, B.C.

The above company is now operating the following extensive collieries on the western slope of the Rocky mountains in the East Kootenay District, namely:—

COAL CREEK COLLIERY, situated on Coal creek, about five miles from the town of Fernie, on a branch railway to the mines, connected at Fernie with the tracks of the Canadian Pacific Railway and also those of the Great Northern Railway.

CARBONADO COLLIERY, situated on Morrissey creek and connected by a branch railway with the Canadian Pacific Railway and the Great Northern Railway at Morrissey. The colliery is about fourteen miles from Fernie by rail in a south-easterly direction. This colliery has been shut down since 1909.

MICHEL COLLIERY, situated on both sides of Michel creek, on the line of the Canadian Pacific Railway, being twenty-three miles in a north-easterly direction from Fernie. This last colliery is in the Northern Inspection District.

The amount and disposition of this combined output of the company's collieries is fully shown in the following table:—

COMBINED RETURNS FROM CROW'S NEST PASS COAL CO.'S MINES FOR YEAR 1918.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	46,462		147,775	
" export to United States	275,140		17,404	
" " other countries				
Total sales		321,602		165,179
Used in making coke	236,307			
Used under colliery boilers, etc	50,909			
Total for colliery use		287,216		
		608,818		
Stocks on hand first of year	64			1,474
" last of year	121			375
Difference {* added to / † taken from} stock during year		*57		†1,099
Output of collieries for year		608,875		164,080

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	41		14		55	
Whites—Miners	357				357	
Miners' helpers						
Labourers	96		228		324	
Mechanics and skilled labour	250		131		381	
Boys	10		16		26	
Japanese						
Chinese						
Indians						
Totals	754		389		1,143	

COAL CREEK COLLIERY.

Bernard Caufield, Manager; R. J. Brown, Assistant Manager.

This colliery, the mines of which are situated on both sides of Coal creek, is connected to both the Canadian Pacific and Great Northern Railways by five miles of track termed the Morrissey, Fernie & Michel Railway.

The mines operated during the year were: On the North side, No. 1 North, No. B North, and No. 9; on the South side, No. 1 South, No. 1 East, Nos. 2 and 3.

All the No. 1 mines are working on the No. 1 seam of coal, which varies from 30 to 40 feet thick; Nos. 2, 3, and 9 operate on the No. 2 seam, which varies from 5.5 to 8 feet thick; and No. B North is about 5 feet thick, height for the roads being obtained by lifting about 5 feet of inferior grade of bottom coal.

The method of work in all the mines is pillar and stall, or some modification of the same, the size of the pillars and stall varying according to the seam, and generally the rule is to drive the entires in pairs, leaving as large a pillar as possible between each pair of entries.

All the work consists of blocking out pillars, and so far during the year no pillars have been extracted in Coal Creek. The direction of dip is generally east and varies from 8 to 12 degrees.

The haulage inside the mine is generally by horses gathering the cars for compressed-air hoists, which bring them either to the main rope, endless rope, or compressed-air locomotives, which deliver them to the tipple. In the case of No. 1 North, No. 1 South, and No. B North, all of which are situated higher than the tipple, gravity-tramways lower the cars to the level of the tipple, and from the foot of these either steam or compressed-air locomotives deliver them to the tipple. The tipple, which is of steel construction, is 840 feet long and extends right across the valley, tracks running east and west along the mountain on both sides of the creek, and is very well equipped to handle a large output of coal.

Two separate and independent circular dumps, each driven by electric motors, delivers the coal to the feed-belt supplying the sizing-screen, which allows the slack to pass through into hoppers, from which it is drawn to load the slack-cars to supply the coke-ovens at Fernie, the screened coal being delivered on to a picking-table, where the foreign matter is picked out before going into the cars. From the picking-table the coal is delivered either into open cars or box cars, two Smith hydraulic loaders providing an easy means of loading the box cars.

The main power plant is situated on the north side of the creek and consists of fourteen boilers having a total capacity of 1,600 horse-power, while an auxiliary plant on the south side provides 600 horse-power. Three air-compressors having a total capacity of over 6,000 cubic feet capacity provide power for the pumps and hoists inside the mine, while a Canadian Rand high-pressure compressor with a capacity of 1,346 cubic feet a minute provides power for the compressed-air locomotives at a pressure of 1,100 lb. to the square inch.

The electric power which is used for No. 1 North, No. 1 South, and No. B North fans, motors, lighting, and to drive all the tipple machinery is provided by two separate Robb-Armstrong engines, each of which drives two 400-ampere, 250-volt generators, and one Crocker-Wheeler 280-ampere, 220-volt generator.

A very well-equipped lamp-room is provided where the lamps used in the mines are cleaned and repaired. The Wolf safety-lamp has been replaced to a great extent by the new Edison electric mine-lamp, 675 of which are in use, while fifty of the Wolf type are in use for testing purposes. Wash and change room is provided for 950 workmen, steel lockers being used, each workman providing his own soap and towel.

The horses from the various mines are brought out at the end of the shift, and three large stables provide accommodation for 140, thus ensuring better conditions and supervision than would be found underground. Adequate machine, blacksmith, carpenter, and locomotive repair-shops are maintained at the mines, in addition to those at Fernie, besides large and commodious warehouses and offices.

A large number of houses are provided at Coal Creek for the convenience of the workmen, and a very good train service is maintained with the town of Fernie, where the remainder of the workmen reside and the principal offices of the company are situated.

No. 1. East Mine.

John Caufield, Overman; Harry Dunlop, James Duncan, Thomas Reid, and James Maltman, Firebosses.

This mine is opened by a crosscut tunnel which reaches the coal at a distance of 215 feet from the entrance, and previous to the bump of November, 1916, was very extensively developed. Since that time only that portion reached by No. 10 East slope has been producing coal, and repair-work has been carried out in the disturbed area.

Ventilation is produced by a double-inlet fan of the Guibal type, driven by belt from a 125-horse-power steam-engine capable of producing 140,000 cubic feet of air a minute, running at 148 revolutions, with a 3.5-inch water-gauge.

The mine is ventilated by two separate splits, called North and South, and at the time of the last inspection the first was producing 33,300 cubic feet of air for the use of thirty-five men and three horses, giving 757 cubic feet of air a minute for each unit. The South split showed

32,900 cubic feet of air a minute for the use of twenty-five men and three horses, or 970 cubic feet a unit.

High percentages of methane have been found during the year, especially in the South split, but, with the exception of early in the year, these have been kept below the adopted standard—namely, 2½ per cent. of methane in the air-current.

During the inspections throughout the year explosive gas has been found eight times, generally in cavities above the timbers, where, due to the soft nature of the coal producing caving, it was very hard to deal with it. The roadways are very well timbered and the "Systematic Timbering" order is very well carried out at the working-faces by the miners.

No. 1. South Mine.

Frank Landers, Overman; William Stockwell, John Strachan, William Hynds, James Taylor, and William Morgan, Firebosses.

Situated about half a mile west of the tipple, this mine works the western portion of the No. 1 seam on the south side of the creek. Ventilation is produced by an 8- x 4-foot Keith fan driven by an electric motor, producing 40,000 cubic feet of air a minute, running at a speed of 254 revolutions a minute, with a 2.8-inch water-gauge.

There is no splitting of the air in this mine, and at the last inspection 39,000 cubic feet of air was circulating for the use of sixty-five men and twelve horses, providing 387 cubic feet of air a minute for each unit.

During the year explosive gas was found on seven occasions, generally in cavities above the timbers, under conditions similar to those in No. 1 East mine. The mine generally is fairly well timbered, and the "Systematic Timbering" order is carried out fairly well by the workmen.

A new approach is being made to this mine, with the idea of installing a larger fan to provide for future development. As previously mentioned, trouble was experienced due to an ignition of fire, curtailing the output of coal for about a month; fortunately this was overcome and the conditions are now normal.

No. 1. North Mine.

Joe Worthington, Overman; Edward Routledge, Thomas Tully, and Matthew Turnbull, Firebosses.

This mine is working on the western portion of the No. 1 seam on the north side of the creek, the conditions being very similar to those in the other mines working this seam, except, being higher up and near the outcrop, very little trouble has been experienced with high percentages of methane.

Ventilation is produced by a 7- x 4-foot Keith fan, driven from a 30-horse-power motor, and at the time of the last inspection was producing 28,000 cubic feet of air a minute for the use of sixty men and eight horses, providing about 333 cubic feet of air a minute for each unit in the mine.

Explosive gas was found only once during the year, and the percentage of methane in the air-current runs well below 1 per cent. The roadways and working-places are all very well timbered, and generally the conditions throughout the mine are very good.

B North Mine.

William Commons, Overman; James White, Herbert Parsons, and Evan Jones, Firebosses.

Situated a short distance to the east of the tipple, this is the only mine working on the B seam.

Ventilation is produced by a 10 x 3-foot Brazil fan, driven by a 30-horse-power motor, producing 40,000 cubic feet of air a minute, running at a speed of 150 revolutions a minute, with a water-gauge of 1 inch.

The mine is ventilated by two separate splits, the Slope and the Incline, and at the last inspection the first showed 17,600 cubic feet of air a minute for the use of forty-five men and four horses, allowing 309 cubic feet a minute for each unit in the mine.

The incline split measured showed 12,000 cubic feet a minute for the use of twenty men and two horses, or 465 cubic feet of air a minute for each unit in the mine.

During the year explosive gas has been found five times, generally due to blowers or feeders from the roof. The roadways were all very well timbered, also the working-faces, but consider-

able trouble has been experienced in getting the workmen to sprag the undermined coal as required by the special rule, with the result that several had to be prosecuted.

No. 2 Mine.

Carmichael McNay, Overman; James Bushell, Walter Clarkstone, and John Mawson, Firebosses.

Situated on the south side of the tipple and almost directly in line with the tipple, this is one of the oldest mines in the valley and has now been developed for a distance of 7,500 feet.

Ventilation is produced by a 16- x 8-foot Wilson fan, driven direct by a 125-horse-power steam-engine, capable of producing 150,000 cubic feet of air a minute at a speed of 132 revolutions a minute, with a 3.5-inch water-gauge.

The mine is ventilated by two splits, called the Rock Tunnel and High Line, and at the last inspection the Rock Tunnel was carrying 10,800 cubic feet a minute for the use of thirty-eight men and five horses, allowing about 204 cubic feet of air a minute for each unit.

The High Line split showed 6,000 cubic feet a minute for the use of five men and one horse, allowing 750 cubic feet of air a minute for each unit in the mine.

Explosive gas has been found three time during the year in this mine, and on two occasions ethane has been recorded by the analysis in the High Line split in small quantities. Conditions on the roadways are fairly good, except in the return air, where it has been very hard to keep it open.

In this case, like very many more, airways are neglected until the amount of repair-work gets so great that it almost seems impossible to overtake it, with the result that the percentage of air produced at the fan which reaches the working-faces is very low. Timbering at the working-faces is very good and plenty is provided convenient for the workmen.

No. 3. Mine.

John Biggs, Overman; W. A. Brown, R. S. Phillips, and Edward Caufield, Firebosses.

This mine is working the dip portion of the No. 2 seam and is connected to it. Ventilation is produced by a fan similar to No. 2 mine, measuring 60,000 cubic feet of air a minute, running at a speed of 148 revolutions a minute, with a 3.5-inch water-gauge. The mine since about April has been ventilated by two separate splits, No. 6 incline and the South Level.

At the last inspection the No. 6 incline split showed 27,600 cubic feet of air a minute for the use of twenty-eight men and four horses, allowing 690 cubic feet of air a minute for each unit.

The South Level split showed 22,100 cubic feet a minute for the use of twenty men and four horses, allowing nearly 700 cubic feet of air a minute for each unit.

Only once during the year has explosive gas been found, and the percentage of methane in the regular air-current has been kept well within the adopted standard of ventilation. As already mentioned, the Main level, counter, and Nos. 5 and 6 inclines were repaired up to the faces and restarted, and all the roadways are very well timbered, and the timbering order covering the working-faces is very well complied with.

No. 9 Mine.

Robert Fowler, Fireboss.

Working on the same seam as Nos. 2 and 3, but on the north side of the valley, this mine was formerly worked long-wall, but had been abandoned for some years. The present work consists of repairing the Main level and the airway.

Ventilation is produced by a 16- x 7-foot fan of the Guibal type, capable of creating about 100,000 cubic feet of air a minute. Owing to there being no active mining the fan is running slow, and at the last inspection was producing 12,000 cubic feet of air a minute for the use of six men and one horse.

Explosive gas was found once during the year; general conditions in respect to timber are very good.

The following are the official returns from the Coal Creek Collieries for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	31,932		82,548	
" export to United States	214,859		4,254	
" other countries				
Total sales		246,791		86,802
Used in making coke	123,326			
" under colliery boilers, etc.	32,289			
Total for colliery use		155,615		
Stocks on hand first of year	64		1,206	
" last of year	121		134	
Difference added to stock during year		57		1,072
Output of collieries for year		402,463		85,730

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC. (INCLUDING FERNIE COKE-OVENS).

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	27		8		35	
Whites—Miners	231				231	
Miners' helpers						
Labourers	62		128		190	
Mechanics and skilled labour	165		73		238	
Boys	8		9		17	
Japanese—Miners						
" Labourers						
Chinese—Miners						
" Labourers						
Indians						
Totals	493		218		711	

The following shows the number of days Coal Creek Colliery worked each month during 1918:—

January	24	August	24½
February	21½	September (21 days on strike)	2
March	20½	October (7 days on strike)	19
April	21½	November	26
May	23	December	24
June	21		
July	21	Total	248

Name of seams or pits—No. 1 North, No. 1 South, and No. 1 East, same seam; No. B; Nos. 2 and 3, same seam; No. 9 not operated in 1918.

MICHEL COLLIERY.

Thomas H. Williams, Manager.

This colliery, operated by the Crow's Nest Pass Coal Company, Limited, is situated on both sides of Michel creek, and is about twenty-four miles east of Fernie, on the Crowsnest Pass branch of the Canadian Pacific Railway, the Great Northern Railway's Rexford branch also connecting to the mines. The mines operated during the year were No. 3 and No. 3 East on the south side of the creek and New No. 8 on the north side.

Both the No. 3 mines are working the upper No. 3 seam, averaging about 10 feet thick, while No. 8 seam is about 12 feet thick; both seams dip at an angle of about 15 degrees to the south.

Both seams are worked pillar and stall; in No. 8 during the year part of the work has been extracting pillars, but in the other mines development-work has been followed. A continuation of the crosscut tunnel which intersects Nos. 3, 4, and 5 seams curtailed the haulage in the No. 3 seam, allowing of more active development. The haulage is by horse gathering the cars from the faces to the landings, from where they are hauled up the slopes by compressed-air hoists and taken to the tipple by compressed-air locomotives.

On the No. 8 side, this mine is situated about 500 feet above the tipple; the cars are dumped into a bunker, from which a skip is loaded, taking the coal down to another bunker at the tipple level, and here the cars are loaded and taken to the tipple by an endless rope.

The tipple is built of structural steel and is 664 feet long and 14 feet wide; all the coal from the South side is weighed at the foot of the incline leading to the tipple; here there is a Green car-haul consisting of a double endless-chain arrangement, which travels on car-wheels with axles which act as spreader-bars, as pushers, and as retarders of the mine-cars when on the incline.

Tracks for the mine-cars are inside the tracks for the cross-bar wheels, and when the car is delivered to the chain-haul the cross-bar moves up to the rear car-wheel and pushes the car up the incline to the dump. The dump, which is simply a continuation of the track, increases gradually from 20 to 60 degrees angle, and when the door of the car is opened the coal discharges on to the dump or screen; the cross-bar, continuing to travel around a large sprocket-wheel, pushes the car on to a swing-lift transfer, while the bar following the sprocket-wheel carries the rear end of the car with it over the top of the sprocket on to the upper or overhead track, by which the car returns down the incline, the cross-bar now acting as a retarder.

On the North or No. 8 side the cars are dumped by an automatic dump, after which a transfer arrangement allows them to return underneath the loaded track to the endless rope, which handles them to and from the coal-bin at the foot of the incline.

The tipple is fully equipped with picking-tables and screens, a conveyor-belt taking the slack to the bins, from which it is drawn as required for the coke-ovens. All the machinery around the tipple is driven by electric motors, and Smith gravity box-car loaders allow of the handling of screened coal with the minimum of breakages.

Two low-pressure compressors provide power for the hoists and pumps inside the mine and No. 8 ventilating-fan outside, one of these being of the Walker and the other a Rand make; the two combined provide about 8,000 cubic feet of free air a minute.

A high-pressure Rand compressor with a capacity of 1,450 cubic feet a minute compressed to 1,200 lb. provides the power for the compressed-air locomotives. Two generators of 250 kw. each supplies the tipple motors and other machinery, in addition to providing for the lights around the tipple and town of Michel, where the majority of the workmen reside. The steam plant consists of eleven boilers with a combined capacity of 1,600 horse-power; this with the power plant is all housed in brick fire-proof buildings.

A very well-equipped lamp-room is maintained where the lamps are cleaned and repaired. As I mentioned last year, the Edison electric mine-lamp has replaced to a great extent the Wolf safety-lamp for the workmen, 320 of these now being in use, while fifteen Wolf safety-lamps are used for inspection purposes. Besides the Wolf safety-lamp, the Burrell gas-detector is in use in all the mines for determining lower percentages of gas than can be detected by the ordinary safety-lamp.

Large and commodious stables are provided for the horses, all of which are brought out of the mine at the end of the day's work. In addition to the above, large machine, blacksmith, carpenter, and car-repair shops are maintained, besides warehouses and offices.

The following is a brief description of the mines and the general conditions therein:—

No. 3 Mine.

Matthew Littler, Overman; Walter Almond, Andrew Frew, and Thomas James, Firebosses.

As previously mentioned, the continuation of the tunnel cutting Nos. 3, 4, and 5 seams, cuts off the slopes driven in the lower No. 3 seam, through which the coal from the Upper seam was hauled and effected a direct connection, resulted in the reopening of the mine early in the year.

The upper No. 3 seam is about 12 feet thick, and owing to the hard nature of the coal is mined by machines of the post type. After being mined it is blasted down with permitted explosive, under the direction of competent officials.

Ventilation is produced by a fan of the Guibal type, 6 feet wide and 12 feet in diameter, driven by a 125-horse-power steam-engine, and creates about 43,000 cubic feet of air a minute, running at a speed of 128 revolutions a minute, with a 1.7-inch water-gauge. At the time of the last inspection this was for the use of thirty-four men and four horses, allowing about 934 cubic feet a minute for each unit in the mine.

The mine generally is very well ventilated and the percentage of methane in the general air-current is less than 1 per cent. The roadways are all fairly well timbered and the timbering of the working-places is very good.

No. 3 East Mine.

Thomas Cunliffe, Overman; Ben Ball, Edward Hayes, and Alfred Ball, Firebosses.

This mine is situated about 3,000 feet east of the tipple. The coal is found outcropping on the side of the creek, and the Main tunnel is driven north, first practically flat for 400 feet, then dipping at an angle of about 14 degrees.

Ventilation is produced by a fan of the Wilson type, driven by a 125-horse-power steam-engine, and produces about 72,450 cubic feet of air a minute, running at a speed of 120 revolutions a minute, with a 2.2-inch water-gauge. This is divided into three splits—No. 6 East, East of slope, and West of slope.

At the last inspection the No. 6 East split was giving 24,000 cubic feet of air a minute for the use of thirty men and five horses, allowing an average of 533 cubic feet of air a minute for each unit in the mine.

East of slope split showed 11,000 cubic feet a minute for the use of twelve men and two horses, giving 611 cubic feet a unit. West of slope split showed 29,700 cubic feet of air a minute for the use of thirty-four men and five horses, allowing 606 cubic feet of air a minute for each unit in the split.

At no time during the year have we found explosive gas in this mine, and the percentage of methane in the air-current has always been well below the adopted standard. The roadways are all very good and the timbering at the faces is well maintained; generally the conditions have been very good.

No. 8 Mine.

Thomas Baybutt, Overman; John Marsh, James Mercer, Alex. Almond, and John Newman, Firebosses.

Situated on the north side of the valley at an elevation of 535 feet above the tipple, this mine is on the same seam as Old No. 8, which was sealed off due to fire in 1911.

Ventilation is produced by a 4- x 8-foot Murphy fan, operated by belt from a 40-horse-power compressed-air-driven engine, and produces about 48,000 cubic feet of air a minute, running at a speed of 200 revolutions a minute, with a 0.75-inch water-gauge.

This ventilation is divided into two splits—No. 1 incline and No. 6 incline splits—and at the time of the last inspection the first was passing 14,000 cubic feet of air a minute for the use of thirty-five men and five horses, allowing 280 cubic feet of air a minute for each unit. The No. 6 incline split was passing 20,160 cubic feet of air a minute for the use of thirteen men and three horses, allowing 916 cubic feet of air a minute for each unit.

During the year very small quantities of explosive gas have been found three times, and the percentage of methane in the general air of the mine has been very low. The roadways and places are very well timbered and generally the conditions are very good.

As previously mentioned, the coal from this mine is hauled to the top of the incline by compressed-air locomotives, weighed and dumped into a coal-pocket, and is afterwards lowered to the tipple level by skip operated as a self-acting incline.

The following are the official returns from the Michel Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	14,530	.....	65,227	.....
" export to United States	60,281	.....	13,150	.....
" " other countries	.....	.....	.....	.....
Total sales	.....	74,811	.....	78,377
Used in making coke	112,981	.....	.....	.....
" under colliery boilers, etc.	18,620	.....	.....	.....
Total for colliery use	.....	131,601	.....	.....
Stocks on hand first of year	.....	.....	268	.....
" last of year	.....	.....	241	.....
Difference taken from stock during year	.....	.....	.....	27
Output of colliery for year	.....	206,412	.....	78,350

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC. (INCLUDING COKE-OVENS).

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	14	.....	6	.....	20	.....
Whites—Miners	126	.....	.....	.....	126	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	34	.....	100	.....	134	.....
Mechanics and skilled labour	85	.....	58	.....	143	.....
Boys	2	.....	7	.....	9	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	261	.....	171	.....	432	.....

The following shows the number of days Michel Colliery worked each month during 1918:—

January	26	August	27
February	23	September (21 days on strike)	2
March	24½	October (6 days on strike)	20
April	25	November	26
May	25	December	24
June	25		
July	25	Total	272½

Name of seams or pits—New No. 3 (top section of No. 3 seam); Old No. 3 (lower section of No. 3 seam); New No. 8; Old No. 8 seam continued.

Corbin Coal and Coke Company, Limited.

Head Office—Spokane, Wash.

Capital, $10,000,000.

Officers.	*Address.*
D. C. Corbin, President,	Spokane, Wash.
J. K. O. Sherwood, Vice-President,	New York, N.Y.
Wm. Weaver Heaton, Secretary-Treasurer,	New York, N.Y.
A. M. Allen, Assistant Treasurer,	Spokane, Wash.
R. S. Ord, General Manager,	Spokane, Wash.
E. L. Warburton, Mine Manager,	Corbin, B.C.

Value of plant, $400,000.

CORBIN COLLIERY.

E. L. Warburton, Manager.

This colliery is situated on the East branch of the South fork of Michel creek, about fourteen miles from McGillivray Junction, on the Crowsnest branch of the Canadian Pacific Railway, and is connected to this by the branch line called the British Columbia Eastern Railway.

During the year Nos. 3, 4, 2, and 5 mines have been operating. No attempt was made to reopen No. 1, which was sealed off owing to a gob-fire some years ago. Most of the coal produced came from Nos. 3 and 4 mines, but owing to the trouble experienced in keeping the road open to the No. 3, or, as it is generally termed, the "Big Showing," during the winter, a large surplus of coal was brought down early in the fall and stacked at Corbin, while active work there was abandoned for the winter.

No. 4 Mine.

James Blair, Overman; Geo. Elmes, Geo. Luck, and Ed. Ainsworth, Firebosses.

This seam, which was the second to be opened at Corbin, is situated about 150 feet west of the No. 1 seam and runs from 50 to 250 feet thick. An outside incline practically goes up on the outcrop of the coal-seam, and openings are made every hundred feet to each side of this. During the year the 400-, 500-, and 600-foot levels were operated, but owing to continued trouble with fire the 600-foot had to be abandoned.

In the other levels the work has been the extraction of pillars on the caving system. In this method blocks are first formed until the point is reached where it is decided to retreat; chutes are then built and the timber withdrawn; this allows the pillar to cave, and owing to the friable nature of the coal it generally continues to run or cave until practically all the coal tributary to it is out, and in most cases the rock fills up the vacancy caused by the extraction of coal. To facilitate the work small raises are maintained convenient to the cave, from which levels are driven to prevent the chute blocking. Nearly all the coal produced in this mine during the year has come from this work, amounting to about 40,000 tons. Several of these chutes are maintained, so that, in the event of one blocking, the coal can be drawn from the others.

The coal-seam being practically vertical, the haulage is horses pulling the loaded cars from the bottom of the chutes to the outside, where they are lowered down to the tipple by a steam-hoist, which hauls up the empty cars.

Ventilation is produced by a 4- x 12-foot fan of the Guibal type, driven direct from a steam-engine, and was producing at the time of the last inspection 25,000 cubic feet of air a minute for the use of twenty-three men and three horses, running at a speed of 100 revolutions a minute, with a water-gauge of 0.5 inch.

During the year the conditions have been fairly good; practically no gas has been found and the places are all well timbered. A plentiful supply of timber is provided for the use of the workmen convenient to the face and the mine is fairly free from coal-dust.

No. 3 Mine, or "Big Showing."

Situated about two miles from Corbin and about 800 feet higher, this, as the name indicates, is an open quarry, the method of work being to strip off the surface soil and coal-blossom, then load the coal direct into the railroad-cars with steam-shovels. Four separate benches permit of the stripping and loading to proceed simultaneously, the railroad car being on an outside track and the steam-shovel between this and the coal. As the coal is extracted the steam-shovel and the railroad-track are moved up as required.

Where the coal is strong, long holes are drilled and blasted to permit the shovel to operate. Stumping-powder is generally used for this purpose, and all the drilling and blasting is under the charge of a certificated person as required by the "Coal-mines Regulation Act." A standard-gauge railway eight miles long switchbacks up to the mine and permits of a fairly good if rapid grade. As I have already mentioned, considerable trouble has been experienced in keeping this road open during the year.

The present pocket of coal being operated is 280 feet thick and is estimated to contain over 1,000,000 tons of coal, to obtain which it is necessary to remove 0.5 ton of cover for every ton of coal recovered.

It is needless to remark that there are no gas, ventilation, or coal-dust problems here and the work is very well supervised. In the Nos. 2 and 5 seams connections have been made to the surface for ventilation and the levels driven in about 300 feet, the work being more of a prospecting nature than anything else so far.

The coal from No. 4 mine is hauled to the tipple by horse, that from the No. 3 mine by locomotive, and if required to be screened it is put over a Marcus screen to be cleaned and sorted as required; if not, it is dumped into the storage-bin, or if from No. 3 mine it is shipped direct.

The power plant consists of four boilers with a combined capacity of 300 horse-power, a 4-stage compressor for supplying the compressed-air locomotives when they are in use, and a 120-kw. alternator which provides lights for the mines and also the village of Corbin, where the workmen reside.

Blacksmith, machine, and car-repair shops are maintained in addition to commodious warehouses and offices. A well-equipped lamp-room is situated at the tipple, where the lamps are cleaned and repaired. Wolf safety-lamps are in use in addition to the Edison electric mine-lamp.

The following are the official returns for the Corbin Coal and Coke Company for the year ending December 31st, 1918:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	31,180			
" export to United States	67,078			
" " other countries				
Total sales		98,258		
Used in making coke				
Used under colliery boilers, etc.	7,731			
Total for colliery use		7,731		
Stocks on hand first of year				
" last of year	18,000			
Difference added to stock during year		18,000		
Output of colliery for year		123,989		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	4		13		17	
Whites—Miners	34				34	
Miners' helpers						
Labourers	22		71		93	
Mechanics and skilled labour			40		40	
Boys						
Japanese						
Chinese						
Indians						
Totals	60		124		184	

During 1918 tipple was built at No. 5 mine to load output in railroad-cars on Leg No. 1 of High Line. New timber-yard and about 500 feet of track were constructed between barn and joiner's shop to facilitate the handling of the mine timbers. Bridge was built over incline and landing made at 300 level to open up basin of coal through right wall, and which level will act as counter to "A" tunnel of No. 4 mine. Fire in No. 4 mine, 600 Left, is still burning, but is sealed off in such a way as to confine it to a very small area. Retreating system of working was commenced in No. 4 mine in May, and about 75 per cent. of the output from this mine has been from this source. No. 3 mine: During the year considerable overburden was removed, and also considerable work done on the industrial railway by widening out cuts and filling-in of bridges. Work at this point was suspended in December for the winter. During the year an ambulance class and examination was held, as a result of which nine certificates were issued.

Names of seams or pits—Coal mountain, operated by No. 3 mine or "Big Showing" by open-work; Nos. 2, 4, and 5 mines being underground workings, and Nos. 2 and 5 being still in prospect stage.

Description of seams, tunnels, levels, shafts, etc., and number of same—Same as per previous reports.

Description and length of tramway, plant, etc.—Same as per previous reports.

SUMMARY—TABLE SHOWING ACCIDENTS OCCURRING IN B.C. COLLIERIES IN TEN YEARS—1909 TO 1918.

For the year	1909.				1910.				1911.				1912.				1913.				1914.				1915.				1916.				1917.				1918.				Total for 10 years.			
Output of coal.....tons	2,400,600				3,139,235				2,193,062				3,025,709				2,570,760				1,810,967				1,972,580				2,485,580				2,398,715				2,578,724				24,575,932			
Number of persons employed	6,418				7,758				6,873				7,130				6,671				5,732				4,991				5,060				5,170				5,427				61,230			
Nature of Injury and Cause of Accident.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.
Gas explosions	32	..	7	39	..	..	6	6	..	..	10	10	7	2	3	12	..	..	13	13	..	1	2	3	23	2	8	33	12	.	..	12	38	..	..	38	..	..	1	1	112	5	50	167
Falls of coal	7	7	4	18	5	16	5	26	3	5	6	14	4	7	9	20	6	4	2	12	2	6	..	8	1	3	3	7	3	5	2	10	1	6	11	18	3	3	1	7	35	62	43	140
Falls of rock	6	13	9	28	8	15	12	35	..	5	24	29	5	9	10	24	11	9	3	23	2	14	..	16	4	7	4	15	7	6	7	20	2	4	14	20	4	10	3	17	49	92	86	227
Mine cars and horses	6	17	24	47	11	49	23	83	5	7	18	30	5	10	10	25	4	28	9	41	5	18	2	25	3	21	2	26	5	15	7	27	1	11	5	17	4	14	5	23	49	190	105	344
Powder, etc., explosion	1	1	3	5	1	1	3	5	..	1	2	3	2	1	..	3	..	2	..	2	2	3	..	5	..	..	1	1	..	..	1	1	..	..	1	1	..	.	2	2	6	9	13	28
Hoisting, ropes, etc	..	..	3	3	..	2	4	6	..	1	1	2	3	7	6	16	1	2	..	3	2	1	1	4	1	4	4	9	..	5	4	9	1	5	5	11	16	..	2	18	24	27	30	81
Mine timber	..	2	3	5	1	4	2	7	..	..	5	5	1	2	2	5	3	6	1	10	..	2	2	4	..	..	..	....	..	2	2	4	..	1	3	4	1	2	3	6	6	21	23	50
Underground, miscellaneous	2	2	2	6	1	4	4	9	4	..	5	9	..	4	4	8	..	..	6	6	3	..	..	3	19	1	3	23	1	3	5	9	1	2	5	8	..	1	2	3	31	17	36	84
On surface, miscellaneous	3	5	4	12	1	4	7	12	4	4	11	19	1	2	3	6	2	6	1	9	1	8	1	10	1	3	1	5	..	..	1	1	..	..	1	1	..	..	..	....	13	32	30	75
	57	47	59	163	28	95	66	189	16	23	82	121	28	44	47	119	27	57	35	119	17	53	8	78	52	41	26	119	28	36	29	93	44	29	45	118	28	30	19	77	325	455	416	1,196

ACCIDENTS IN BRITISH COLUMBIA COLLIERIES DURING 1918.

| Cause of Accident and Nature of Injury. | Name of Colliery. | | |

ANALYSES OF ACCIDENTS DURING YEAR 1918.

District.	No. of Accidents per 1,000 Men employed.				Tons of Coal mined per Accident.			
	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.
East Kootenay	3.76	6.02	0.07	10.55	146,573	91,483	732,864	52,347
Coast	5.60	5.36	4.39	15.36	80,254	83,902	102,547	29,299
Total for Province	5.15	5.52	3.50	14.19	92,097	85,957	135,722	33,489

PER CAPITA PRODUCTION OF COLLIERIES.

District.	Gross Tons of Coal mined in 1918.	Total Number of Men employed by Producing Collieries.	Tons of Coal mined per Man employed at Collieries.	Number of Men employed Underground in Producing Collieries.	Tons of Coal mined per Man employed Underground.
East Kootenay	732,864	1,327	552	814	900
Coast	1,845,860	4,100	450	2,944	649
Total for Province	2,578,724	5,427	475	3,658	704

ACCIDENTS IN MINES DURING 1918.

COAL-MINES.

District.	Fatal.	Serious.	Slight.	Total.
East Kootenay	5	8	1	14
Nicola	2	2	2	6
Coast	21	20	16	57
Totals	28	30	19	77

METAL-MINES.

West Kootenay-Similkameen	7	5	4	16
Coast	5	6	8	19
Totals	12	11	12	35
Grand totals of all accidents	40	41	31	112

DETAILED STATEMENT OF ACCIDENTS IN B.C. COLLIERIES DURING 1918.

COAST COLLIERIES.

REPORTED BY HENRY DEVLIN AND JOHN NEWTON, INSPECTORS.

No.	Colliery.	Date.	Name.	Occupation.	Details.
1	Wellington-Extension (C.C.)	Jan. 16	John Vanetti	Miner	Simple fracture of right tibia, caused by fall of rock.
2	Grant. (N.C.C.)	Jan. 16	Joseph Casorzo	Winch-boy	Broken arm, caused by being jammed between two cars.
3	Comox (C.C.)	Mar. 9	Leung Hee	Loader	Fractured left arm, caused by fall of coal.
4	Wellington-Extension (C.C.)	" 15	John Tapella	Miner	Friction burn about face and hands, caused by blown-out shot.
5	Reserve (C.W.F.C.)	" 20	Karl Oercharick	Pusher	Fractured forearm, caused by being caught between two cars.
6	No. 1 (C.W.F.C.)	" 28	A. J. Hayes	Motorman	Fractured ribs and internal injury, caused by being jammed between rib and motor.
7	Reserve (C.W.F.C.)	April 3	Thos. Johnson	Miner	Bruised shoulder and small projection of scapula broken off, caused by being struck by stringer.
8	Nanaimo (C.W.F.C.)	" 5	Hugh Gilmore	Driver	Dislocated hip-joint, caused by being squeezed between car and side.
9	Harewood (C.W.F.C.)	" 8	Samuel Dean	Rope-rider	Fractured leg, caused by being squeezed between two cars.
10	Morden (P.C.C.M.L.)	" 9	Mike Bennock	Miner	Struck by coal, causing compound fracture of right tibia.
11	No. 1 shaft (C.W.F.C.)	" 13	John Towers	Machine-miner	Fourth finger of right hand amputated, caused by being caught between cam-plate and bracket.
12	Comox (C.C.)	" 19	Mah Wing	Miner	Rock fell and caused bruised and lacerated left shoulder and lacerated right forearm.
13	Comox (C.C.)	May 1	Ronald Delaney	Driver-boss	Going up trip was caught against timber, causing broken collar-bone and badly bruised ribs.
14	Reserve (C.W.F.C.)	" 10	Joseph Dawson	Labourer	Bruised head and shoulders, fractured ribs, caused by runaway trip.
15	Comox (C.C.)	" 18	Joseph Salmon	Machine-miner	Fall of rock caused compound fracture of right leg above ankle.
16	No. 1 (C.W.F.C.)	" 18	Costin Leyonard	Driver	Foot caught between bumper of car and floor while riding loaded-car, fracturing big toe of left foot.
17	Wellington-Extension (C.C.)	June 4	George Wilson	Miner	Dislocated right ankle, caused by displacement of post which let car run down hill.
18	Wellington-Extension (C.C.)	" 7	Louis Charlier	Miner	Fatally injured by fall of overhanging coal and dirt.
19	Harewood (C.W.F.C.)	" 10	Thos. Aitken	Miner	Broken arm, caused by fall of rock.
20	Reserve (C.W.F.C.)	" 22	Verner W. Tisu	Driver	Death through crushed head and body by falling in front of trip; cause unknown.
21	Comox (C.C.)	July 3	Y. Oda	Miner	Fall of coal caused compound fracture of right leg below knee.
22	Granby No. 1 (G.C.M.S. & P.C.)	" 16	Mike Agabba	Mucker	Muscular bruises of thigh and arm, left side, caused by mine-car being derailed.
23	Comox (C.C.)	" 18	Alexander McLeod	Miner	Compound fracture of skull, lacerated scalp, fracture of right cheek-bone, nose, and right leg; rock fell.
24	Comox (C.C.)	" 27	Leung Chee	Miner's helper	Fall of cap-rock caused dislocated hip and cuts on head.
25	No. 1 (C.W.F.C.)	Aug. 8	William D. Scott	Miner	Fall of rock fractured tibia-bone in left leg.

ACCIDENTS IN COAST COLLIERIES—*Concluded.*

No.	Colliery.	Date.	Name.	Occupation.	Details.
26	Morden (P.C.C.M.L.)	Aug. 9	Tony Commentucci.	Miner	Simple fracture of the right tibia and fibula, caused by fall of coal.
27	Comox (C.C.)	Aug. 30	Chin Chong	Miner	Making wedge with axe, struck left hand with blade, cutting it severely.
28	No. 1, Protection (C.W.F.C.)	Sept. 10	M. Eussa	Loader	Killed by rope breaking when seventh cage of men was descending.
29	Ditto	" 10	Lionel Barlow	Miner	Ditto.
30	"	" 10	Angelo Sedola	Miner	"
31	"	" 10	Caleb Price	Miner	"
32	"	" 10	Jos. Sturma	Loader	"
33	"	" 10	Robert Kelly	Timberman	"
34	"	" 10	James Bond	Loader	"
35	"	" 10	Jos. Turner	Loader	"
36	"	" 10	Augusto Eussa	Loader	"
37	"	" 10	David Eddy	Miner	"
38	"	" 10	Rathom Maisuradse	Brusher	"
39	"	" 10	Wm. Blinkhorne	Loader	"
40	"	" 10	John Rollo	Miner	"
41	"	" 10	T. Bonaz	Brusher	"
42	"	" 10	John Kernahan	Miner	"
43	"	" 10	Robert McArthur	Miner	"
44	Comox (C.C.)	" 18	Hop Yuen	Driver	Left leg crushed by being caught by hook on tail-chain when turning mule around.
45	Wakesiah (C.W.F.C.)	" 30	Harry Fletcher	Sinker	Loose rock fell on left foot and fractured little toe.
46	Comox (C.C.)	Oct. 21	Ronald Delaney	Driver-boss	Rock fell from roof, striking him and causing bruised back and limbs.
47	Comox (C.C.)	" 22	Peter Bobba	Brusher	Rock fell and crushed his skull, proving fatal.
48	No. 1 (C.W.F.C.)	" 25	A. B. Watson	Rope-rider	Right thigh-bone broken, caused by piece of coal falling off car and causing it to jump track.
49	Granby No. 1 (G.C.M.S.P.C.)	" 28	John Powell	Miner	Slight burns on face, neck, and back of hands, caused by using naked light on his head.
50	Comox (C.C.)	Nov. 1	Cho Wood Young	Miner's helper	Fracture of right leg, caused by rock falling and knocking out timber, which fell on his leg.
51	Harewood (C.W.F.C.)	Nov. 22	Steven Melzer	Miner	Coal fell and fractured left arm.
52	Comox (C.C.)	Nov. 27	Jung Dong	Driver	Mule kicked him on lower jaw, fracturing it.
53	Reserve (C.W.F.C.)	Dec. 7	David Byers	Driver	Fractured leg caused by derailed car.
54	No. 1 (C.W.F.C.)	" 11	Alex. McCracken	Rope-rider	Struck by runaway car, which caused crushed pelvis; fatal.
55	Harewood (C.W.F.C.)	" 14	Ed. Milburn	Motor-siding [attendant	Caught by shoulder between cars, breaking right collar-bone.
56	No. 1 Mine (C.W.F.C.)	" 27	Andrew Malcolm	Driver	Crushed foot, necessitating amputation of the toe, caused by car running over foot.
57	Telkwa (T.C.)	" 13	M. F. Hennessy	Miner	Bruised in the face and upper part of body by returning too soon on shot.

NICOLA COLLIERIES.

REPORTED BY ROBERT STRACHAN, SENIOR INSPECTOR, AND JOHN NEWTON, INSPECTOR.

58	Coal Hill (F.C.C.)	Feb. 13	Joseph McPhee	Timberman	One rib broken and one fractured by falling and knocking post, which struck him.
59	Middlesboro (M.C.L.)	Mar. 16	Matthew McKibben	Fireboss	Struck by piece of lagging, fracturing his right collar-bone.
60	Coal Hill (F.C.C.)	April 16	Henry Kinnear	Miner	Fatally injured by fall of roof.

ACCIDENTS IN NICOLA COLLIERIES—*Concluded.*

No.	Colliery.	Date.	Name.	Occupation.	Details.
61	Middlesboro..... (M.C.L.)	June 13	Thomas Colquhoun.	Miner	Broken rib on left side, caused by stepping on loose timber, which rolled, causing him to fall.
62	Coal Hill..... (F.C.C.)	Aug. 28	Steve Radick.....	Miner	Fall of coal, which struck him on the head, killing him instantly.
63	Middlesboro..... (M.C.L.)	Nov. 14	Archibald Grieve ..	Rope-rider	Small toe of right foot broken by derailment of loaded car.

CROWSNEST PASS DISTRICT.

REPORTED BY ROBERT STRACHAN AND WILLIAM LANCASTER, INSPECTORS.

64	Michel ..... (C.N.P.C.C.)	Jan. 21	A. Pittas.....	Driver.....	Link attached to loose end of rope struck his leg, causing compound fracture of left leg.
65	Coal Creek..... (C.N.P.C.C.)	Jan. 24	Giovanni Qualtieri.	Miner	Slipped on loose coal and boom fell on his leg, fracturing fibula.
66	Coal Creek .... (C.N.P.C.C.)	Feb. 1	Wm. Zingiera.....	Driver.....	Back wheels of car slipped off track and struck him, fracturing two ribs on right side.
67	Michel ..... (C.N.P.C.C.)	Feb. 10	G. Hyshka.....	Miner	Fractured fibula, caused by fall of rock.
68	Michel ..... (C.N.P.C.C.)	Feb. 14	M. Danyluk	Motorman	Broken leg and internal injuries, caused by apparently being struck by bumper of motor.
69	Coal Creek..... (C.N.P.C.C.)	Mar. 4	Johan Mayok	Miner on company work	Fractured shoulder-blade, caused by fall of loose rock.
70	Coal Creek ..... (C.N.P.C.C.)	Mar. 16	A. Kaleta	Miner	Piece of rock fell off side, causing fatal injuries.
71	Michel ..... (C.N.P.C.C.)	April 24	Wm. Dunn	Fireboss	Fractured ribs on both sides and internal injuries, caused by being struck by timber.
72	Coal Creek..... (C.N.P.C.C.)	April 29	Andro Knatko	Driver.....	Struck by boom, which fractured his skull.
73	Coal Creek..... (C.N.P.C.C.)	July 8	James Wills	Tracklayer's helper	Roof fell on him, fatally injuring him.
74	Michel ..... (C.N.P.C.C.)	July 13	Frank Breniskesky.	Machineman's helper	Neck and lower jaw broken, caused by being caught between drum and post, fatally injuring him.
75	Corbin ..... (C.C. & C.C.)	Aug. 5	George Luk.....	Fireboss	Overcome by methane, fell down chute; head cut and bruised to vault of cranium.
76	Coal Creek..... (C.N.P.C.C.)	Dec. 5	Matthew Zelinckas.	Miner	Piece of rib coal struck him on side of leg, causing fracture of middle of right thigh.
77	Coal Creek..... (C.N.P.C.C.)	Dec. 16	Harold Jones	Driver.....	Horse backed loaded car, which threw him, and horse stepped on right leg, breaking it.

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

As is incumbent upon the Inspector, he has laid information before the local Magistrates in the following cases of infractions by the workmen in the mines of the General and Special Rules and Regulations which are provided for the safety of all underground employees. The carelessness of one man endangers the lives of his fellow-workmen, and is treated as a criminal offence.

The following prosecutions have been brought during the year for the offences noted; the judgments given by the Magistrate being shown:—

Date.	Name.	Occupation.	Mine.	Offence charged.	Judgment.
Jan. 9	M. Keperwitch	Miner	Corbin.....	Breach of Special Rule 115....	Fined $10 and costs.
" 9	M. Kosin	Miner	Corbin.....	Breach of Special Rule 115....	Fined $10 and costs. Adjourned to Jan. 25th.
" 10	A. Murphy....	Miner	Nanaimo No. 1	Violating Co's. Special Rule 126	Fined $10 and costs. Certificate cancelled for one month
" 10	Jacob Stobbart	Fireboss	Nanaimo No. 1	Violating Co's. Special Rule 126	Fined $10 and costs. Certificate cancelled for two months
" 19	Geo. Biguoff...	Pusher.....	Reserve	Having matches in his possession	Fined $10 and costs.
" 19	Paul Ebaner...	Pusher.....	"	Having matches in his possession	Fined $10 and costs.
" 19	Pete Bernhond	Miner	"	Having matches in his possession	Fined $10 and costs.
" 19	Jos. Dickson..	Faceman....	" .... [Creek	Tamping shot-hole with inflammable substance	Case dismissed.
" 22	R. Romagnoli..	Miner	B. North, Coal	Breach of Special Rule 114....	Fined $10 and costs.
Feb. 22	Lee Yien.....	Labourer....	No. 6, Comox..	Smoking and having matches in possession	Sent to gaol for three months with hard labour.
Mar. 8	Geo. Mackie...	Miner	Reserve	Having matches in his possession	Fined $10 and costs.
" 28	J. Schmeltzer..	"	B. North, Coal [Creek	Breach of Special Rule 114....	Fined $10 and costs.
" 28	Jan. Staron....	"	B. North, Coal [Creek	Breach of Special Rule 114....	Fined $10 and costs.
" 28	M. Albo	"	B. North, Coal [Creek	Having lucifer matches in his possession	Fined $5 and costs.
April 4	John Tapella..	"	No. 1, Well. [Extension	Violation of General Rule 12, Sec. 91, C.M.R.A.	Sentenced to fifteen days in gaol.
April 4	D. J. Gordon..	Fireboss	No. 1 Well. Extension	Violation of special Rule 44....	Fined $10 and costs.
Aug. 28	B. Volpatti....	Miner	No. 8, Michel..	Breach of Special Rules 57 and 115	Ordered to pay costs, $3.25.
" 28	J. Volpatti....	"	" ..	Ditto	Ditto.
" 28	S. Quarrin	"	" ..	"	"
" 28	A. Depauly....	"	" ..	"	"
" 28	S. Veneir	"	" ..	Breach of Special Rule 12.....	Fined $10 and costs.
" 28	J. K. Ashman.	Mine fore- [man	Telkwa.....	Breach of General Rule 12.....	Fined $10 and costs.

METALLIFEROUS MINES SHIPPING IN 1918.

CASSIAR.

ATLIN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Engineer	Windy arm.	Reginald Brook	Atlin	Gold, silver.
Maid of Erin	Rainy Hollow	Richard Kennedy	Seattle	Silver, copper.

SKEENA.

SKEENA MINING DIVISION.

Belmont Surf Inlet	Surf inlet	Belmont Surf Inlet Mines, Ltd.	Surf Inlet	Gold, silver, copper.
Drum Lummon	Douglas channel	Drum Lummon Mines, Ltd	Vancouver	Gold, silver, copper.

NASS RIVER MINING DIVISION.

Golkiesh	Anyox	H. W. Heidman	Anyox	Gold, silver.
Hidden Creek	Anyox	Granby Cons. M. S. & P. Co.	Anyox	Gold, silver, copper.
La Rose	Alice arm	Miles Donald	Alice Arm	Gold, silver.

PORTLAND CANAL MINING DIVISION.

Bush	Salmon river	R. K. Neill, Manager	Stewart	Gold, silver.

QUEEN CHARLOTTE MINING DIVISION.

Bank of Commerce	Jedway	A. J. Wilds	Jedway	Copper.
Ikeda	Ikeda bay	A. Ikeda	Ikeda	Gold, silver, copper.

OMINECA MINING DIVISION.

Copper Queen	Telkwa	Fred Griffin [Ltd	Telkwa	Gold, silver, copper.
Hazelton View	Rocher Déboulé mount.	New Hazelton Gold-Cobalt Mines,	Vancouver	Gold.
Rocher Déboulé	Rocher Déboulé mount.	Rocher Déboulé Copper Co.	Tramville	Gold, silver, copper.
Silver Standard	Hazelton	Silver Standard	New Hazelton	Gold, silver, lead, zinc.

EAST KOOTENAY.

FORT STEELE MINING DIVISION.

Burton	Elko	Daly-Burton Copper Syndicate	Kimberley	Copper.
North Star	Kimberley	O. C. Thompson	Kimberley	Silver, lead.
St. Eugene	Moyie	St. Eugene Leasing Co	Moyie	"
		Consolidated M. & S. Co.	Kimberley	"
Sullivan	Kimberley	Consolidated M. & S. Co.	Kimberley	"

WINDERMERE AND GOLDEN MINING DIVISIONS.

Isaac	Isaac creek	H. E. Forster	Wilmer	Silver, lead.
Mabel R.	Boulder creek	Frank Anderson	Wilmer	"
Paradise	Toby creek	R. Randolph Bruce	Invermere	"
Silver Belt	Windermere	Duncan Brander	Kimberley	"
Star (Hot Punch)	Toby creek	J. E. Stoddart	Windermere	Gold, silver, lead.
Couverapee	(Golden) Field	Wm. Adkins	Field	Silver, lead.

WEST KOOTENAY.

AINSWORTH MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Bell & Sunset	Jackson basin	Jackson Basin Zinc Co	Kaslo	Silver, lead.
Bluebell	Riondel	The New Canadian Metal Co., Ltd	Riondel	Silver, lead.
Cork-Province	Zwicky	Cork-Province Mines, Ltd	Kaslo	Silver, lead, zinc.
Florence	Ainsworth	Florence Silver Mining Co., Ltd.	Spokane	Silver, lead.
Gallagher	Ainsworth	McVicar & Smith	Ainsworth	"
Gibson	Kaslo	Gibson Mining Co., Ltd	Kaslo	"
Highland	Ainsworth	Consolidated M. & S. Co	Trail	"
Jessie Bluebird	Woodbury creek	Eric Johnson	Kaslo	"
Lavina	Argenta	G. A. Lafferty	Rossland	"
Lincoln	Adamant	Columbia Mining Co	New Denver	"
Little Phil	Ainsworth	J. W. Smith	Ainsworth	"
Maestro	Ainsworth	H. Giegerich	Kaslo	"
Mohawk	Adamant	Ray J. Hughes	Kaslo	"
Montezuma	Kaslo creek	H. Giegerich	Kaslo	Zinc.
No. 1	Ainsworth	Consolidated M. & S. Co	Trail	Silver.
Skyline	Ainsworth	H. Giegerich	Ainsworth	Silver.
Spokane Trinket	Ainsworth	James McDougall	Ainsworth	Silver, lead.
Tam O'Shanter	Riondel	C. F. Sherwin	Riondel	Silver.
Tariff	Ainsworth	J. W. Smith	Ainsworth	Silver, lead.
Utica	Paddy peak	Utica Mines, Ltd	Kaslo	Silver, lead.
Whitewater	Retallack	J. L. Retallack & Co	Kaslo	Gold, silver, lead, zinc.

SLOCAN MINING DIVISION.

Best	Sandon	W. A. Cameron	New Denver	Silver, lead.
Bosun	Sandon	J. P. MacFadden	Sandon	Silver, lead, zinc.
Echo	Silverton	Echo Silver Lead Mining Co	Silverton	Silver, lead.
Freddie Lee	Sandon	M. M. McCune	Nelson	Gold, silver, lead.
Galena	Silverton	Galena Mining & Milling Co	Silverton	Silver, lead.
Gem	Carpenter creek	Frank Edwards	Sandon	Silver, lead.
Hewitt	Silverton	Clarence Cunningham	Sandon	Silver, lead, zinc.
Idaho-Alamo	Sandon	Clarence Cunningham	Sandon	Silver, lead.
Lily B	Slocan City	W. A. Buchanan	Nelson	Silver, lead.
Lucky Thought	Silverton	Consolidated M. & S. Co	Trail	Silver.
Lucky Jim	Zincton	A. W. Allen	Victoria	Silver, zinc.
Number One	Sandon	J. M. Harris	Sandon	Silver, lead.
Payne	Sandon	Andrew Anderson (lessee)	Sandon	Silver, lead.
Payne	Sandon	J. A. Black (lessee)	Sandon	Silver, lead.
Queen Bess	Sandon	Clarence Cunningham	Sandon	Silver, lead.
Rambler-Cariboo	Rambler	W. A. Cameron	Three Forks	Silver, lead, zinc.
Reco	Sandon	J. M. Harris	Sandon	Silver, lead.
Ruth	Sandon	James Anderson	Kaslo	Silver, zinc.
Silversmith	Sandon	Silversmith Mines, Ltd	Sandon	Silver, lead.
Slocan Soverign	Sandon	Clarence Cunningham	Sandon	Silver, lead.
Standard	Silverton	Standard Silver Lead Mining Co.	Silverton	Silver, lead.
Surprise	Sandon			
Van-Roi	Silverton	Clarence Cunningham	Sandon	Silver, lead, zinc.
Victoria	Payne mountain	John Worgan	Sandon	Gold, silver, lead.
Wonderful	Sandon	Clarence Cunningham	Sandon	Silver, lead.

SLOCAN CITY MINING DIVISION.

Anna	Springer creek	Kurt E. Zimmerman	Slocan	Silver, copper.
Arlington	Slocan	H. D. Curtis	Slocan	Silver, lead.
Black Prince	Lemon creek	J. T. Tipping	Slocan	Silver.
Eastmont	Slocan	H. D. Lea	Slocan	Silver, lead.
Evening Star	Slocan	Jas. O'Shea, Box 1080	Nelson	Gold, silver.
L. T.	Springer creek	D. B. O'Neail	Slocan	Silver, lead.
Meteor	Lemon creek	G. H. Aylard	Victoria	Gold, silver.
Ottawa	Slocan	Consolidated M. & S. Co	Trail	Silver.
Republic	Springer creek	G. E. Laird	Nelson	Gold, silver.
Silver Cliff	Ten-mile creek	P. Swan	Slocan	Silver, lead.

NELSON MINING DIVISION.

Aspen	Salmo	Mrs. H. M. Billings	Salmo	Gold, silver.
Emerald	Salmo	Iron Mountain, Ltd	Salmo	Silver, lead.
Eureka	Eagle creek	Eureka Copper Mines, Ltd	Nelson	Gold, silver, copper.
Molly Gibson	Kokanee	Consolidated M. & S. Co	Trail	Silver, lead.
Ore Hill	Salmo	C. H. Cassill	Ovando, Mont.	Gold, silver, lead.
Orinoco	Beasley	Michael Egan	Nelson	Gold, silver, copper.
Queen	Sheep creek	Queen Gold Mining Co	Sheep creek	Gold, silver.
Relief	Erie	A. D. Westby	Erie	Gold, silver, copper.
Spokane	Bayonne mountain	R. M. & K. K. Laib	Salmo	Gold, silver, lead.
Yankee Girl	Ymir	Hobson Silver Lead Co., Ltd	Ymir	Gold, silver. lead.

ARROW LAKE MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Millie Mack	Burton	H. E. Forster	Wilmer	Gold, silver, lead.

TRAIL CREEK MINING DIVISION.

Centre Star	Rossland	Consolidated M. & S. Co.	Rossland	Gold, silver, copper.
Inland Empire	Paulson	Inland Mining Co	Paulson	" "
Le Roi No. 2	Rossland	Le Roi No. 2, Ltd.	Rossland	" "
Mountain Chief	Renata	Owen Wheeler	Rock creek	" "
Velvet	Rossland	Granby Cons. M. S. & P. Co.	Phoenix	" "
War Eagle	Rossland	Consolidated M. & S. Co.	Rossland	" "
White Bear	Rossland	Consolidated M. & S. Co.	Rossland	" "

TROUT LAKE AND LARDEAU MINING DIVISIONS.

Ethel	Trout lake	Silver Crown Mining Co., Ltd.	Trout Lake	Silver, lead.
Ferguson	Ferguson	Ferguson Mines, Ltd.	Kaslo	Gold, silver, lead.
Fidelity	Horsefly creek	F. C. Elliott	Victoria	Gold, silver, lead.
Monte Christo	Silverton	L. Hillman	Silverton	Gold, silver, lead.
Triune	Ferguson	Triune Gold & Silver M. & M. Co.	Ferguson	Gold, silver, lead, zinc.
True Fissure	Ferguson	True Fissure M. & M. Co.	Ferguson	Gold, silver, lead.
Winnipeg	Boyd creek	Arthur Evans	Beaton	Silver, lead.

BOUNDARY.

GRAND FORKS MINING DIVISION.

B.C	Eholt	Canada Copper Corporation	Allenby	Silver, copper.
Emma	Grand Forks	Consolidated M. & S. Co.	Trail	Gold, silver, copper.
Lightning Peak	Kettle river	W. A. Calder	Edgewood	Gold, silver, lead.
Mastodon	Castle mountain	Stewart Calvert Co.	Orville, Wn.	Chrome.
Rock Candy	Grand Forks	Consolidated M. & S. Co.	Trail	Fluorspar.
Stemwinder	Phoenix	New Dominion Copper Co., Ltd.	Allenby	Gold, silver, copper.
Union	Franklin camp	Lewis Johnson	Grand Forks	Gold, silver.

GREENWOOD MINING DIVISION.

Aftermath	Greenwood	W. R. Richard	Greenwood	Gold, silver, copper.
Bell	Wallace mountain	Oliver & McIntosh	Beaverdell	Silver, lead.
Big Copper	Greenwood	James Poggi	Greenwood	Silver, copper.
Black Diamond	Beaverdell	P. J. Kennedy	Beaverdell	Silver.
Bounty Fraction	Beaverdell	P. E. Crane	Greenwood	Silver, lead.
Cariboo-McKinney	Camp McKinney	F. G. Scace	Toronto	Gold, silver.
Enterprise	Greenwood	C. Scott MacRae	Deadwood	Silver, copper.
Freemont	"	J. H. Duhamel	Greenwood	Gold, silver.
Motherlode	"	Canada Copper Corporation, Ltd.	Allenby	Gold, silver, copper.
Phoenix	"	Granby Cons. M. S. & P. Co.	Phoenix	Gold, silver, copper.
Providence	"	A. J. Morrison	Greenwood	Gold, silver.
Rambler	Beaverdell	W. Rambo	Beaverdell	Silver, lead.
Sally	Kettle river	James Drum	Beaverdell	Silver, lead.
Sappho	Midway	Edward Mellrud	Greenwood	Silver, copper.
Standard Frac.	Beaverdell	J. L. Nordman	Beaverdell	Silver, lead.
Sudbury	Deadwood	Jas. D. Graham	Deadwood	Gold, silver, copper.
Sunnyside	Kettle river	E. Williamson	Rock creek	Gold, silver, lead.
Sunset	Greenwood	New Dominion Copper Co., Ltd.	Allenby	Gold, silver, copper.
Surprise No. 3	Skylark camp	J. E. Thompson, M.L.A.	Phoenix	Copper.
Waterloo	Kettle river	G. Boug & C. Hamerstadt	Edgewood	Gold, silver, lead.

OSOYOOS MINING DIVISION.

Dolphin	Keremeos	C. W. Jordan	Keremeos	Silver, copper.
Golconda	Keremeos	D. McEachren	Keremeos	Silver, copper.
Horn Silver	Similkameen	Lessees, Horn Silver Mine	Similkameen	Gold, silver, copper.
Nickel Plate	Hedley	Hedley Gold Mining Co.	Hedley	Gold, arsenic.
Thirsk	Thirsk	Sandberg Bros.	Penticton	Gold, silver, lead.
Torpedo	Penticton	Duncan J. McIntyre	Penticton	Gold, silver.

SIMILKAMEEN, NICOLA, AND VERNON MINING DIVISIONS.

Copper Mountain	Allenby	Canada Copper Corporation, Ltd.	Allenby	Gold, silver, copper.
Big Sioux	Aspen Grove	R. R. Hedley	Nicola	Silver, copper.
Hunter	Nicola	George H. Allen	Victoria	Gold, silver, copper.

YALE, ASHCROFT, AND KAMLOOPS MINING DIVISIONS.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Emancipation	Hope	Emancipation Mining Co., Ltd.	Hope	Gold, silver.
Chataway	Ashcroft	Frederick Keffer	Spokane	Silver, copper.
Iron Mask	Kamloops	Kamloops Copper Co., Ltd.	Kamloops	Gold, silver, copper.
Maxine No. 2	Kamloops	C. B. Frederick	Tranquille	Silver, copper.

LILLOOET MINING DIVISION.

Lorne	Cadwallader creek	Lorne Amalgamated Mines, Ltd.	Lorne	Gold, silver.
Pioneer	Cadwallader creek	Pioneer Gold Mines, Ltd.	Lillooet	Gold, silver.
Ida May	Cadwallader creek			

SOUTH COAST.

VANCOUVER MINING DIVISION.

Britannia	Britannia beach	Britannia Mining & Smelting Co.	Britannia Beach	Gold, silver, copper.
Summit	Mons	J. H. Thompson	Vancouver	Iron.

NANAIMO MINING DIVISION.

Ingersoll	Quadra island	Valdes Island Copper Co., Ltd.	Victoria	Silver, copper.
Loyal	Blubber bay	James Raper	Vananda	Gold, silver, copper.
Marble Bay	Vananda	Tacoma Steel Co.	Vananda	Gold, silver, copper.

VICTORIA MINING DIVISION.

Blue Grouse	Cowichan lake	G. H. Kilburn	Cowichan lake	Silver, copper.
Margaret	Sooke	East Sooke Mines, Ltd.	East Sooke	Gold, silver, copper.
Willow Grouse	Sooke	Manager	East Sooke	Silver, copper.

CLAYOQUOT AND QUATSINO MINING DIVISIONS.

Indian Chief	Sidney inlet	Tidewater Copper Co.	Sidney Inlet	Gold, silver, copper.

ALBERNI MINING DIVISION.

Monitor	Alberni	J. A. Skene	Port Alberni	Silver, copper.

LIST OF CROWN-GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1918.

CASSIAR.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
A.B. Fraction	Omineca	Joseph S. Kelly and Randolph Haigh	5451 R. 5	5.12	Mar. 21
Belleview No. 1	Skeena	William Thomas Kergin and George Rudge	3508	51.65	Feb. 4
Belleview Fraction	"	William Thomas Kergin and George Rudge	3507	42.38	Feb. 4
Belleview No. 2	"	William Thomas Kergin and George Rudge	3506	48.17	Feb. 4
Blenheim	"	William Thomas Kergin	3509	47.21	Feb. 4
Brown Bear	"	Millard F. Warren	2099 R. 4	32.31	Mar. 25
Camp Bird Fraction	"	Millard F. Warren	2100 R. 4	35.06	May 15
Cascade Falls No. 4	Portland Canal	Oakley Beaufort Bush	3590	32.00	May 2
Cascade Falls No. 8	Portland Canal	Oakley Beaufort Bush	3591	42.00	May 2
Centre Fraction	Omineca	Debenture Creek Mines, Ltd., N.P.L.	6316 R. 5	1.33	April 3
Contact	"	James Gilmore and James E. Dean	3182	50.67	July 15
Copper Hill	"	Andrew Fairburn and Horace S. Lavery	3320	36.82	May 9
Crescent	"	Joseph Burr Tyrrell	3835	33.65	Sept. 19
Dalby	Portland Canal	Reginald King Neill	3595	51.65	May 2
Dominion Fraction	Omineca	James Gilmore and James E. Dean	3179	16.20	July 15
Essington	Portland Canal	Oakley Beaufort Bush	3593	47.05	May 2
Gem	Skeena	B.C. Salt Works, Ltd	6499	42.38	Oct. 29
George	Skeena	B.C. Salt Works, Ltd	6497	32.21	Oct. 29
Golden Chief	Omineca	Joseph Burr Tyrrell	3323	40.32	Sept. 19
Golden Potlatch	"	Joseph Burr Tyrrell	3834	48.25	Sept. 19
Golden Wonder	"	Joseph Burr Tyrrell	3322	34.30	Sept. 19
Granite	"	James Gilmore and James E. Dean	3184	34.00	July 15
Homestake	Stikine	Fred. E. Bronson, Peter C. McCormack, George H. Whitney, Bruno Grief, and Cassius M. Coulter	2858	42.69	Aug. 30
Little Helen	Omineca	Andrew Fairburn and Horace S. Lavery	3319	36.97	May 9
Little Maid	Atlin	Jules Eggert	226	38.89	Feb. 4
Little Tomy Fraction	Skeena	Millard F. Warren	2098 R. 4	42.37	Mar. 20
Louise	Portland Canal	Robert Musket Stewart	1555	51.65	Nov. 20
Maple Leaf	Omineca	Joseph Burr Tyrrell	3836	29.89	Sept. 19
Mermaid	Stikine	Fred. E. Bronson, Peter C. McCormack, George H. Whitney, Bruno Grief, and Cassius M. Coulter	2860	50.20	Aug. 30
North Star	Skeena	Gustaf Pearson	3634	21.01	Sept. 19
Nugget	Omineca	Joseph S. Kelly and Randolph Haigh	5450 R. 5	51.65	Mar. 19
Observatory	Skeena	Millard F. Warren	2101 R. 4	49.66	Mar. 20
Pat Fraction	Portland Canal	Reginald King Neill	3594	22.82	May 2
Pictou	Portland Canal	Oakley Beaufort Bush	3596	51.61	May 2
Quartsite	Omineca	James Gilmore and James E. Dean	3186	25.84	July 15
Queena	Omineca	Michael J. Kolb	6285 R. 5	50.14	May 9
Reno	Omineca	James Gilmore and James E. Dean	3183	30.10	July 15
Red Bluff	Stikine	Fred. E. Bronson, Peter C. McCormack, George H. Whitney, Bruno Grief, and Cassius M. Coulter	2857	51.65	Aug. 30
Red Bird	Stikine	Fred. E. Bronson, Peter C. McCormack, George H. Whitney, Bruno Grief, and Cassius M. Coulter	2859	42.60	Aug. 30
Right Rim	Omineca	Debenture Creek Mines, Ltd.	6314 R. 5	50.70	April 3
Rupert	Portland Canal	Oakley Beaufort Bush	3597	49.72	May 2
Rupert	Skeena	B.C. Salt Works, Ltd	6498	24.38	Oct. 29
Scranton	"	B.C. Salt Works, Ltd	6500	39.66	Oct. 29
Sea Gull	"	Millard F. Warren	2097 R. 4	49.90	Mar. 20
Sea Lion Fraction	"	Millard F. Warren	2104 R. 4	48.04	May 15
Shamrock	Omineca	Byron R. Jones	3712	45.42	Aug. 9
Sheet Anchor Fraction	Skeena	Millard F. Warren	2105 R. 4	44.88	Mar. 20
Simpson	Portland Canal	Oakley Beaufort Bush	3592	31.00	May 2
Skeena	Omineca	Andrew Fairbairn and Horace S. Lavery	3321	34.88	May 9
Skyline	Skeena	Millard F. Warren	2106 R. 4	49.90	Mar. 20
Snow Fraction	Skeena	William Thomas Kergin and George Rudge	3653	9.18	Feb. 4
Stark Fraction	Nass River	William Thomas Kergin, George Rudge, and William Rose Lord	2344	12.19	Nov. 20
Summit	Omineca	James Gilmore and James E. Dean	3180	51.65	Sept. 19
Sunlight Fraction	Skeena	Millard F. Warren	2103 R. 4	25.92	Mar. 20
Sunshine	Omineca	James Gilmore and James E. Dean	3181	48.70	July 15
Surprise	"	Byron R. Jones	3711	40.44	Aug. 8
Valley View	"	James Gilmore and James E. Dean	3185	33.00	July 15
Wonderful	"	Byron R. Jones	3710	40.01	Aug. 9
Zeolitic No. 1	"	Joseph S. Kelly and Randolph Haigh	5447 R. 5	51.65	Mar. 21
Zeolitic No. 2	"	Joseph S. Kelly and Randolph Haigh	5446 R. 5	51.61	Mar. 21
Zeolitic No. 4	"	Joseph S. Kelly and Randolph Haigh	5448 R. 5	45.70	Mar. 21
Zeolitic No. 5	"	Joseph S. Kelly and Randolph Haigh	5449 R. 5	41.96	Mar. 21

EAST KOOTENAY.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Alvarado	Fort Steele	The Consolidated M. & S. Co. of Canada	12516 G. 1	50.90	Mar. 18
Angus Fraction	"	Consolidated M. & S. Co.	12518 G. 1	34.19	May 17
April Fraction	"	Consolidated M. & S. Co.	12521 G. 1	37 07	Mar. 18
Carbajal Fraction	"	Consolidated M. & S. Co.	12515 G. 1	45.03	Mar. 18
Charlotte Fraction	"	Consolidated M. & S. Co.	12514 G. 1	45.64	Mar. 18
Empire	"	Consolidated M. & S. Co.	12517 G. 1	34.81	May 17
Empire	Golden	John Murdock McLeod	506 G. 1	51.65	June 12
Ernestine Fraction	Fort Steele	Consolidated M. & S. Co.	12522 G. 1	43.14	Mar. 18
Josephine	Fort Steele	Consolidated M. & S. Co.	12524 G. 1	46.05	April 4
Jumbo	Windermere	Bessie Shaw	293	20.66	Aug. 22
Kathleen Fraction	Fort Steele	Consolidated M. & S. Co.	12520 G. 1	27.76	May 17
Mohican	Fort Steele	Consolidated M. & S. Co.	3051 G. 1	43.16	May 9
Monitor	Golden	Arthur Emerson Rand	651 G. 1	20.66	June 13
Pauline	Fort Steele	Consolidated M. & S. Co.	12525 G. 1	51.65	April 4
Tipperary	Fort Steele	Consolidated M. & S. Co.	12523 G. 1	51.65	Mar. 18
Ward	Fort Steele	Consolidated M. & S. Co.	12519 G. 1	51.65	May 17

WEST KOOTENAY.

American Eagle	Slocan	William Edwin Graham	5499 G. 1	34.14	June 5
Baltimore Fraction	Slocan	Murdock McLean	3522 G. 1	50.53	Mar. 16
Beatrice Fraction	Nelson	George Mortimer Davidson	4741 G. 1	22.61	Nov. 26
Bell No. 2	Slocan	William Edward Graham	5500 G. 1	49.08	June 5
Cabin Fraction	Slocan	Consolidated M. & S. Co.	12598 G. 1	50.32	
Carolina	Nelson	Harris Ginsberg	12531 G. 1	51.65	May 15
Chapleau	Slocan	Emily Ada Harris	4963 G. 1	26.12	Aug. 28
Chapleau Con. Fraction	Slocan	Emily Ada Harris	4966 G. 1	0.81	Aug. 28
Connie Fraction No. 2	Ainsworth	Walter Magoon	5818 G. 1	50.70	Nov. 21
Drum Lumon	"	Richard H. Graves	7370 G. 1	49.20	Mar. 18
Ellen	"	Henry Giegerich	980 G. 1	14.20	June 12
Fletcher	"	Albert Henry Watkins	5608 G. 1	22.19	Nov. 21
Freemont	Nelson	John Dingwall McDonald	2928 E. 1	34.53	Oct. 16
Gold Bug No. 2	Trail Creek	Guy Alexander Lafferty	1154	17.30	Sept. 24
Gold Leaf Fraction	Nelson	James A. Gilker, Administrator of the estate of Jons Person Swedberg, deceased	12458 G. 1	18.20	June 8
Gold Leaf No. 2	Nelson	James A. Gilker, Administrator of the estate of Jons Person Swedberg, deceased	12457 G. 1	46.01	June 8
Gray Rock	Nelson	Harris Ginsberg	12534 G. 1	49.03	May 15
Havana	Ainsworth	Albert Henry Watkins	5610 G. 1	35.84	Nov. 21
Helena	Slocan	Carl Westin	4238 G. 1	33.40	Oct. 10
Helen No. 2	Trail Creek	Lana A. Blondin	1151 G. 1	43.21	July 30
Humboldt	Nelson	Lorne Argyle Campbell	3929 G. 1	51.07	Oct. 16
Imperial	Nelson	David E. Grobe	3025 G. 1	37.43	Oct. 22
Isabella No. 2	Trail Creek	Ernest Morrison	1355 G. 1	44.21	July 10
Last Fraction	Ainsworth	Consolidated M. & S. Co.	12408 G. 1	14.85	June 5
London	Slocan	Henry Giegerich	1416 G. 1	47.29	June 12
Lost Lode	Ainsworth	Consolidated M. & S. Co.	12404 G. 1	51.65	Feb. 5
Monte Christo Fraction	Trail Creek	Consolidated M. & S. Co.	12172 G. 1	3.09	April 15
Morning	Ainsworth	Helen Johnston	6818 G. 1	33.11	Mar. 15
Old Abe	Nelson	Harris Ginsberg	12533 G. 1	41.86	May 15
Old Mike	Nelson	Harris Ginsberg	12532 G. 1	49.20	May 15
Onix	Nelson	Lorne Argyle Campbell	3926 G. 1	23.36	Oct. 16
Orizaba	Trail Creek	Lana A. Blondin	1153 G. 1	42.10	July 25
Peerless	Slocan	John Baillargeon	1812 G. 1	41.78	June 12
Phoenix	Trail Creek	Guy Alexander Lafferty	1152	20.79	Sept. 24
Reciprocity	Ainsworth	James Wilson Smith and James Russell Hardie	12407 G. 1	44.64	Nov. 27
Republic No. 2	Slocan	Jesse Thompson Tipping, Administrator of the estate of Lida A. Tipping, deceased	5498 G. 1	50.91	June 5
Ruth	Ainsworth	Consolidated M. & S. Co.	10696 G. 1	39.00	April 4
Silver Reef	Ainsworth	Consolidated M. & S. Co.	12403 G. 1	47.29	Feb. 5
Sleve-na-mon	Lardeau	William Joseph Butler and Owen Rowland	4761 G. 1	29.37	Sept. 6
St. Peter Fraction	Trail Creek	Consolidated M. & S. Co.	11475 G. 1	11.09	April 15
Thompson Fraction	Ainsworth	Consolidated M. & S. Co.	12405 G. 1	47.23	Feb. 5
Victoria Fraction	Nelson	Consolidated M. & S. Co.	12273 G. 1	38.48	April 4
Washington	Ainsworth	James Wilson Smith and James Russell Hardie	12406 G. 1	38.39	Nov. 27

BOUNDARY.

Ada B	Clinton	Frank Calvert	4792 G. 1	51 65	Nov. 20
Apex	Ashcroft	George H. Chataway, George Ward, and Mark L. McAbee	3645 G. 1	51.47	Oct. 4
August	Similkameen	Canada Copper Corporation	366 S.	21.90	June 18
Beta	Kamloops	Glen Iron Mining Co., N.P.L.	1414 G. 1	51.65	Oct. 21
Blackbird	Similkameen	Canada Copper Corporation	2272 S.	33.12	Nov. 26
Britannia Fraction	Kamloops	Angela Beckman	2554 G. 1	19.16	Jan. 16
Brandon	Grand Forks	James McNulty, James Marshall, and Thomas Roderick	2382 G. 1	45.72	Sept. 18
Chicago	Similkameen	Canada Copper Corporation	2264 S. 1	19.57	June 21
Clifford	Clinton	Frank Calvert	4791 G. 1	51.65	Nov. 20
Copper King	Kamloops	Angela Beckman	1457 G. 1	51.65	Feb. 7
Diamond	Similkameen	James F. Cunningham, John Mulligan	1326	51.65	June 24
Duke	Ashcroft	Jane Sanson, Administratrix, estate Geo. Sanson, deceased	3641 G. 1	32.11	Oct. 6
Granite Mountain	Similkameen	Canada Copper Corporation	2050 S.	23.80	Nov. 29
Grey Rock	Similkameen	Canada Copper Corporation	2051 S.	45.50	Nov. 26
Hercules	Similkameen	Albert T. Bryant & Charles W. Staples	1511 S.	38.49	June 1

BOUNDARY—*Concluded.*

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Idaho	Similkameen	Canada Copper Corporation	2049 S.	30.24	Nov. 26
I.O.U.	Ashcroft	George H. Chataway, George Ward, and Mark L. McAbee	3643 G. 1	51.65	Oct. 4
I.X.L.	Ashcroft	Jane Sanson	3646 G. 1	36.42	Oct. 4
Jessie	Similkameen	Canada Copper Corporation	2269 S.	48.74	June 21
Major Fraction	Ashcroft	Jane Sanson, Administratrix, estate Geo. Sanson, deceased	3642 G. 1	26.24	Oct. 5
Mooney	Similkameen	Canada Copper Corporation	2268 S.	35.20	June 18
Montana	Similkameen	Canada Copper Corporation	2048 S.	28.60	Nov. 26
Norah	Kamloops	Glen Iron Mining Company	1413 G. 1	51.65	Oct. 21
O.K.	Ashcroft	George H. Chataway, George Ward, and Mark L. McAbee	3644 G. 1	49.13	Oct. 4
Oregon	Similkameen	Canada Copper Corporation	2265 S.	33.29	Nov. 26
Princess Carolina Frac.	Similkameen	Canada Copper Corporation	2284 S.	36.78	Dec. 10
Princess Helen No. 1	Similkameen	Canada Copper Corporation	2271 S.	46.14	June 25
Shamrock	Ashcroft	Jane Sanson, Administratrix, estate Geo. Sanson, deceased	1245A. G. 1	51.61	Oct. 5
Slamet	Greenwood	Ellen Hallett	2663	38.12	Aug. 28
Signorina	Kamloops	Angele Beckman	2555 G. 1	47.18	Jan. 16
Star	Ashcroft	Jane Sanson, Administratrix, estate Geo. Sanson, deceased	1246A. G. 1	51.65	Oct. 5
Tamarac	Ashcroft	Jane Sanson, Administratrix, estate Geo. Sanson, deceased	1244A. G. 1	37.90	Oct. 5
Tam O'Shanter	Greenwood	Allan John Morrison	2405	39.77	Aug. 8

VANCOUVER ISLAND AND COAST.

Ajax	Vancouver	Britannia M. & S. Co	4642 G. 1	51.65	Dec. 20
Alert	"	"	4776 G. 1	50.50	July 19
Arctic	"	"	4633	49.47	Dec. 12
Atlantic	"	"	4640 G. 1	51.65	Dec. 20
Barney	"	"	4798 G. 1	51.65	July 19
Bean Fraction	Quatsino	Coast Copper Company	1472	9.02	Nov. 27
Behr Fraction	Vancouver	Britannia M. & S. Co	4791 G. 1	47.88	July 19
Belchor No. 1	Nanaimo	The Hematite Mining Co	1063 R. 2	51.65	Oct. 2
" 2	"	"	1064 R. 2	49.78	" 2
" 3	"	"	1065 R. 2	35.58	" 2
" 4	"	"	1066 R. 2	48.95	" 2
" 5	"	"	1067 R. 2	43.26	" 2
" 6	"	"	1068 R. 2	23.06	" 2
" 7	"	"	1069 R. 2	51.06	" 2
" 8	"	"	1070 R. 2	38.81	" 2
Beta Fraction	Vancouver	Britannia M. & S. Co	3947 G. 1	12.67	Mar. 13
Betty	Vancouver	Britannia M. & S. Co	4857 G. 1	51.52	July 19
Billy Frac	Vancouver	Britannia M. & S. Co	3720 G. 1	6.11	Mar. 13
Black Jack Frac	Quatsino	Edward F. Walsh	1498	25.82	Mar. 22
Bluebell	Nanaimo	The Hematite Mining Co	1084 R. 2	35.74	Oct. 2
Boulder Canyon No. 1	Quatsino	John Jacob Badraun	1546	40.73	Dec. 6
Briton	Nanaimo	The Hematite Mining Co	1062 R. 2	51.65	Oct. 2
Broad Fraction	Vancouver	Britannia M. & S. Co	4636 G. 1	44.77	Dec. 13
Bulliondale No. 1	"	Robert Mungall	4649	46.26	Nov. 6
" 2	"	"	4650	35.27	" 6
" 3	"	"	4651	27.35	" 6
" 5	"	"	4653	34.35	" 6
Bute Fraction	"	Britannia M. & S. Co	4632 G. 1	42.32	Dec. 12
Chal Fraction	"	"	4797 G. 1	43.81	July 19
Chas	"	"	4801 G. 1	51.65	July 19
Candor Fraction	"	"	4386 G. 1	50.74	Feb. 19
Copper Dyke	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd	704 R. 2	51.58	April 23
Copper Dyke Extension	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd	703 R. 2	51.65	April 23
Copper Prince	Vancouver	James Williams	2083 G. 1	51.65	June 5
Copper Queen	Vancouver	David Singleton	2082 G. 1	39.06	June 5
Curzon Fraction	Vancouver	Britannia M. & S. Co	4876 G. 1	13.93	Sept. 13
Dada Fraction	Quatsino	Coast Copper Co	1491	10.55	Nov. 18
Defiance	Vancouver	Britannia M. & S. Co	4578 G. 1	51.65	Dec. 12
Delta	Vancouver	Britannia M. & S. Co	3714 G. 1	48.80	Feb. 15
Derby Fraction	Vancouver	Britannia M. & S. Co	4982 G. 1	9.44	Sept. 13
Dorothy M. Fraction	Quatsino	Coast Copper Co	1479	7.17	Nov. 27
Drew Frac	Vancouver	Britannia M. & S. Co	4625 G. 1	38.22	Sept. 13
Drum	Vancouver	Britannia M. & S. Co	4635 G. 1	51.65	Dec. 12
Dutch Fraction	Quatsino	Coast Copper Co	1467	6.49	Nov. 12
Eden	Vancouver	Britannia M. & S. Co	4624 G. 1	51.54	Mar. 19
Edith Fraction No. 1	Quatsino	Coast Copper Co	1490	14.51	Nov. 21
Elsa	Quatsino	Coast Copper Co	1476	40.15	Nov. 27
Enid	Nanaimo	William Robert Taylor	280 R. 1	46.25	June 13
Ernie Fraction No. 1	Quatsino	Coast Copper Co	1497	1.76	Dec. 11
Eve Fraction	Vancouver	Britannia M. & S. Co	4793 G. 1	43.13	July 19
Faith	Vancouver	Britannia M. & S. Co	4580 G. 1	51.65	Dec. 12
Fin Fraction	Vancouver	Britannia M. & S. Co	4622 G. 1	48.68	Mar. 19
Finish Fraction	Quatsino	Coast Copper Co	1468	8.92	Nov. 13
First Chance No. 1	Quatsino	Coast Copper Co	1466	51.65	Nov. 12
Gill	Vancouver	Britannia M. & S. Co	4619 G. 1	51.65	Mar. 19
Golby-Fen-Ding Fraction	Quatsino	Coast Copper Co	1489	14.28	Nov. 18
Grant	Vancouver	Britannia M. & S. Co	4799 G. 1	45.33	July 19
Happy Jack	Quatsino	Coast Copper Co	1495	51 00	Nov. 18
Harp Fraction	Vancouver	Britannia M. & S. Co	4641 G. 1	49.37	Mar. 19
Heather	Nanaimo	The Hematite Mining Co	1083 R. 2	37.38	Oct. 2
Hecla Fraction	Vancouver	Britannia M. & S. Co	4639 G. 1	40.85	Dec. 13
Heron H	Quatsino	Coast Copper Co	1482	40.15	Nov. 15
Howe	Vancouver	Britannia M. & S. Co	4629 G. 1	51.65	Dec. 12
Idaho	Quatsino	Anna Adams	1487	51.65	Mar. 22

VANCOUVER ISLAND AND COAST.—*Concluded.*

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Idaho Fraction	Quatsino	Nick Badraun	1481	31.96	Mar. 22
Indian Fraction	Vancouver	Britannia M. & S. Co	4631 G. 1	39.69	Dec. 12
Iron Crown No. 7	Nanaimo	The Hematite Mining Co	1071 R. 2	51.64	Oct. 2
Iron Prince Fraction	Victoria	Harrie Gerald Ross	214	14.83	Aug. 29
Isaac T	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd	701 R. 2	41.57	April 23
Ivory Fraction	Vancouver	Britannia M. & S. Co	4634 G. 1	38.89	Mar. 19
Jennie B	Nanaimo	Thomas Neil Phillips	278 R. 1	42.53	June 13
Jersey	Vancouver	Britannia M. & S. Co	4645	51.65	Dec. 20
Jinx Fraction	Quatsino	Coast Copper Co	1477	18.16	Nov. 27
Julie	Nanaimo	Thomas Neil Phillips	233 R. 1	38.84	June 13
Juno Fraction	Vancouver	Britannia M. & S. Co	4159 G. 1	50.73	Feb. 19
Ken Fraction	Vancouver	Britannia M. & S. Co	4800 G. 1	48.56	July 18
King Fisher Fraction	Quatsino	Adolf A. Gyes	1532	19.68	Aug. 29
Lady of the Lake	Vancouver	Robt. Mungall	4654 G. 1	38.73	Nov. 9
Last Chance No. 1	Quatsino	Coast Copper Co	1465	51.65	Nov. 12
Leora Fraction	Vancouver	Britannia M. & S. Co	4643 G. 1	45.92	Dec. 20
Machete Fraction	Quatsino	Coast Copper Co	1501	20.77	Nov. 19
Maude H. Fraction	Quatsino	Coast Copper Co	1504	1.62	Nov. 19
Max	Vancouver	Britannia M. & S. Co	4792 G. 1	46.74	July 19
Merry Widow No. 1	Quatsino	Adolf A. Gyes	1529	51.48	Aug. 29
Milner Fraction	Vancouver	Britannia M. & S. Co	4981 G. 1	46.07	Sept. 13
Monarch	Nanaimo	The Hematite Mining Co	1076 R. 2	43.57	Oct. 2
Naas Fraction	Vancouver	Britannia M. & S. Co	4627 G. 1	49.23	July 19
Nancianna Fraction	Quatsino	Coast Copper Co	1485	10.03	Nov. 15
Nancy Lee	Quatsino	Coast Copper Co	1469	51.65	Nov. 27
Nellie S	Quatsino	Coast Copper Co	1470	51.65	Nov. 27
No. 24 Fraction	Vancouver	Britannia M. & S. Co	3996 G. 1	27.64	Mar.
Ogden	Vancouver	Britannia M. & S. Co	4773 G. 1	50.51	July 19
Old Sport No. 4	Quatsino	Harry George Adams	1493	51.65	Mar. 23
" 1	"	Maynard T. McClure	1480	51.65	" 23
" 2	"	Edward F. Walsh	1486	50.96	" 23
" 6	"	William M. Halliday	1499	51.65	" 25
" 11	"	Coast Copper Co	1500	48.89	" 25
" 9	"	Coast Copper Co	1494	49.78	" 25
Orpha Fraction	"	Coast Copper Co	1496	4.15	Nov. 19
Pacific	Vancouver	Britannia M. & S. Co	4638 G. 1	51.65	Dec. 13
Patricia Fraction	Vancouver	Britannia M. & S. Co	4577 G. 1	50.66	Dec. 12
Perch Fraction	Vancouver	Britannia M. & S. Co	4369 G. 1	50.44	Feb. 19
Percy F. Curtiss	Quatsino	Joseph Hunter and Andrew Tait Monteith	529	44.94	Aug. 21
Prince Fraction	Vancouver	Britannia M. & S. Co	3949 G. 1	46.38	Mar. 13
Read Fraction	"	"	4626 G. 1	51.62	Mar. 19
Royalist	"	"	2201 G. 1	51.65	Mar.
Sage	"	"	4630 G. 1	51.65	Dec. 12
Satellite	"	"	2202 G. 1	51.65	Mar. 7
Shamrock No. 2	Quatsino	Nils S. Nilson	1484	51.65	Mar. 25
Shamrock No. 3	Quatsino	Frederick William Kenmuir	1478	51.65	Mar. 21
Shark	Vancouver	Britannia M. & S. Co	4378 G. 1	48.92	Feb. 19
Shirley Fraction	Vancouver	Britannia M. & S. Co	4795	50.60	Dec. 20
Singer	Vancouver	Britannia M. & S. Co	4637 G. 1	51.65	Dec. 13
Sockeye	Quatsino	Joseph Hunter and Andrew Tait Monteith	528	49.53	Aug. 21
Some Fraction	Quatsino	Coast Copper Co	1488	29.46	Nov. 18
Sourdough Fraction	Quatsino	Coast Copper Co	1473	21.56	Nov. 27
Spokane	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd	702 R. 2	39.40	April 23
Stella	Nanaimo	William Robert Taylor	281 R. 1	25.60	June 13
Success	Vancouver	Britannia M. & S. Co	4628 G. 1	51.65	Dec. 12
Sunloch No. 3	Victoria	Sunloch Mines, Ltd., G. E. Winkler, C. W. Frank, D. W. Hanbury	794	35.89	Aug. 6
Sunloch No. 4	"	Ditto	795	38.22	Aug. 6
Sunloch No. 5	"	"	796	30.91	Aug. 6
Sunloch No. 1	"	"	792	51.59	Sept. 19
Sunloch No. 2	"	"	793	50.97	" 19
Sunloch No. 6	"	"	797	32.54	" 19
Surf Fraction	Vancouver	Britannia M. & S. Co	4623 G. 1	48.16	" 13
Tatlico	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd	699 R. 2	51.35	April 23
Tintic Fraction	Vancouver	Britannia M. & S. Co	4647 G. 1	14.02	Dec. 20
Toba	Vancouver	Britannia M. & S. Co	4620 G. 1	51.65	Mar. 18
Turkey Fraction	Vancouver	Britannia M. & S. Co	4390 G. 1	44.22	Feb. 19
Tyee	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd	700 R. 2	51.65	April 23
Union Fraction	Vancouver	Britannia M. & S. Co	4774 G. 1	51.04	July 19
Van	"	"	4796 G. 1	51.65	July 19
Wally Fraction	"	"	4855 G. 1	57.81	July 19
Wasp Fraction	"	"	4782 G. 1	46.67	Sept. 13
Weary Willie Fraction	Quatsino	Coast Copper Co	1483	16.60	Nov. 15
Yeo Fraction	Vancouver	Britannia M. & S. Co	4621 G. 1	51.48	Mar. 19

DEPARTMENT OF MINES.

VICTORIA, B.C.

Hon. WM. SLOAN, *Minister of Mines.*

R. F. TOLMIE, *Deputy Minister.*

WM. FLEET ROBERTSON, *Provincial Mineralogist and Assayer.*

GEO. WILKINSON, *Chief Inspector of Mines.*

HENRY DEVLIN, *District Inspector*, Nanaimo.

JOHN NEWTON, *District Inspector*, Nanaimo.

ROBERT STRACHAN, *District Inspector*, Fernie.

WM. LANCASTER, *District Inspector*, Fernie.

JAMES MCGREGOR, *District Inspector*, Nelson.

THOS. J. SHENTON, *District Inspector*, Prince Rupert.

H. H. JOHNSTONE, *Temporary Inspector*, Nelson.

D. E. WHITTAKER, *Provincial Analyst and Assistant Assayer.*

J. D. GALLOWAY, *Resident Engineer*, Hazelton.

W. M. BREWER, *Resident Engineer*, Nanaimo.

GEO. A. CLOTHIER, *Resident Engineer*, Prince Rupert.

P. B. FREELAND, *Resident Engineer*, Grand Forks.

A. G. LANGLEY, *Resident Engineer*, Revelstoke.

R. W. THOMSON, *Resident Engineer*, Kamloops.

GOLD COMMISSIONERS AND MINING RECORDERS.

Mining Divisions.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Atlin Mining Division	Atlin	J. A. Fraser	W. G. Paxton	
Sub-office	Telegraph Creek			H. W. Dodd.
"	Haines (U.S.)		(Com. for taking Affidavits)	Risdon M. Odell.
Stikine Mining Division	Telegraph Creek	H. W. Dodd	H. W. Dodd	
Sub-office	Boundary	"	"	C. A. Tervo.
Liard Mining Division	Telegraph Creek	"	"	
Sub-office	Porter			Chas. H. Smith.
"	McDame Creek			Mike Larsen.
"	Fort St. John			F. W. Beatton.
Skeena Mining Division	Prince Rupert	J. H. McMullin	J. H. McMullin	
Sub-office	Alice Arm			Telka Carney.
"	Kitimat			Geo. L. Anderson.
"	Port Simpson			J. R. C. Deane.
"	Copper City			P. R. Skinner.
"	Terrace			T. J. Kirkpatrick.
"	Stewart (Portland Canal)			P. S. Jack.
Nass River	Anyox	J. H. McMullin	H. Andrew	
Portland Canal M.D.	Stewart	J. H. McMullin (at Prince Rupert)	P. S. Jack	
Bella Coola Mining Div.	Prince Rupert	J. H. McMullin	J. H. McMullin	Brynild Brynildsen.
Sub-office	Bella Coola			
"	Bella Bella			John A. Pauline.
Queen Charlotte Min'g D.	Queen Charlotte	J. H. McMullin	John L. Barge	
Sub-office	Jedway			Isaac Thompson.
"	Masset			C. Harrison.
"	Lockeport			William Morgan.
Omineca Mining Division	Smithers	Stephen H. Hoskins	Jas. E. Kirby	
Sub-office	Fort Grahame			Einar Ursino.
"	Fort St. James			Alex. C. Murray.
"	Manson Creek			W. B. Steele.
"	Telkwa			T. J. Thorp.
"	Fort St. John			F. W. Beatton.
"	Copper City			P. R. Skinner.

Gold Commissioners and Mining Recorders—*Continued.*

Mining Divisions.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Omineca M.D.—*Con.*				
Sub-office	Terrace			T. J. Kirkpatrick.
"	New Hazelton			L. B. Warner.
"	Fort Fraser			J. S. Alexander.
"	Junction Finlay &	Parsnip rivers		
"	Pacific			T. H. McCubbin.
"	Hazelton			Sperry Cline.
"	Burns Lake			R. C. Macdonald.
"	Houston			
"	Usk			Jas. L. Bethurum.
Peace River Mining Div.	Fort St. John	S. H. Hoskins	F. W. Beatton	
Sub-office	Hudson Hope	(at Hazelton)		John Gregg.
"	Pouce Coupe			G. J. Duncan.
Cariboo Mining Division	Barkerville	L. A. Dodd		
Sub-office	Quesnel	"		E. C. Lunn.
"	Fort George	"		T. W. Herne.
"	McBride	"		Thos. Van Dyk.
Quesnel Mining Division	150-Mile House	C. W. Grain	R. M. McGusty	
Sub-office	Quesnel	(at Barkerville)		E. C. Lunn.
"	Quesnel Forks			Grant Grinder.
"	Barkerville			L. A. Dodd.
Clinton Mining Division	Clinton	Geo. Milburn		
Lillooet Mining Division	Lillooet	John Dunlop	John Dunlop	
Kamloops Mining Division	Kamloops	E. Fisher	L. S. Brown	
Sub-office	Chu Chua			George Fennell.
"	Vavenby			Hyde Finley.
"	Albas			C. O. Sjouquist.
Ashcroft Mining Division.	Ashcroft	E. Fisher (at Kam.)	H. P. Christie	
Sub-office	Lytton			Thos. Somerville.
Nicola Mining Division	Merritt	E. Fisher (at Kam.)	J. A. Murchison	
Yale Mining Division	Yale	" "	H. Beech	
Similkameen Mining Div.	Princeton	Hugh Hunter	Hugh Hunter	
Sub-office	Hedley			T. H. Rotherham.
Vernon Mining Division	Vernon	L. Norris	H. F. Wilmot	
Greenwood Mining Div.	Greenwood	W. R. Dewdney	W. R. Dewdney	
Sub-office	Vernon			H. F. Wilmot.
"	Rock Creek			S. T. Larsen.
"	Beaverdell			E. F. Ketchum.
Grand Forks Min. Div.	Grand Forks	S. R. Almond	S. R. Almond	
Osoyoos Mining Division	Fairview	J. R. Brown		
Sub-office	Olalla			R. W. Northey.
"	Hedley			T. H. Rotherham.
Golden Mining Division	Golden	John Bulman	G. E. Sanborn	
Windermere Mining Div.	Wilmer	" (at Golden)	E. M. Sandilands	
Fort Steele Mining Div.	Cranbrook	N. S. A. Wallinger.		
Sub-office	Steele			Joseph Walsh.
"	Fernie			Ronald Hewat.
"	Moyie			W. H. Laird.
"				
Ainsworth Mining Div	Kaslo	R. J. Stenson	A. McQueen	Wm. J. Green.
Sub-office	Howser			W. Simpson.
"	Trout Lake			Oscar Jacobson.

GOLD COMMISSIONERS AND MINING RECORDERS—*Concluded.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Ainsworth M.D.—*Con.*				
Sub-office	Crawford Bay			Thos. W. Lytle.
"	Poplar			Arthur G. Johnston.
Slocan Mining Division	New Denver	R. J. Stenson	Angus McInnes	
Sub-office	Sandon	(at Kaslo)		W. J. Parham.
Slocan City Mining Div.	Slocan	R. J. Stenson	Thos. McNeish	
Trout Lake Mining Div.	Trout Lake	"	Oscar Jacobson	
Nelson Mining Division	Nelson	E. Ferguson (Actg.)	S. S. Jarvis	
Sub-office	Creston			R. Lamont.
"	Ymir			Wm. Dowling.
"	Sheep Creek			Geo. Leece.
"	Salmo			G. A. Kennington.
Arrow Lake Min. Division	Nakusp	E. Ferguson	Walter Scott	
Sub-office	Vernon	(at Nelson)		H. F. Wilmot.
Revelstoke Mining Div.	Revelstoke	A. Johnson	J. Lee	Newton R. Brown.
Lardeau Mining Division	Beaton	" (at Revelstoke)	Francis I. Fraser	
Trail Creek Mining Div.	Rossland	H. R. Townsend	M. S. Morrell	
Nanaimo Mining Division	Nanaimo	S. McB. Smith	S. McB. Smith	
Sub-office	Ladysmith			John Stewart.
"	Alert Bay			Ernest H. Robinson
"	Vananda			Leonard Raper.
"	Quathiaski Cove			S. Marshall.
"	Granite Bay			Henry Twidle.
"	Campbell River			T. W. Hanson.
Alberni Mining Division	Alberni	A. G. Freeze	A. G. Freeze	
Clayoquot Mining Division	Clayoquot	" (at Alberni)	W. T. Dawley	
Quatsino Mining Division	Quatsino	" "	Ed. Evensen	
Victoria Mining Division	Victoria	Herbert Stanton	Herbert Stanton	
New Westminster Min. D.	New Westminster.	F. C. Campbell	I. Wintemute	
Sub-office	Harrison Lake			L. A. Agassiz.
"	Chilliwack			J. Pelly.
Vancouver Mining Div.	Vancouver	John Mahony	A. P. Grant	

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BRITISH COLUMBIA

DEPARTMENT OF MINES

Hon. Wm. Sloan, Minister.
R. F. Tolmie, Deputy Minister. W. Fleet Robertson, Provincial Mineralogist.
Geo. Wilkinson, Chief Inspector of Mines.

BULLETIN NO. 2, 1919

THE COMMERCIAL FEASIBILITY OF THE ELECTRIC SMELTING OF IRON ORES IN B.C.

BY

ALFRED STANSFIELD, D.Sc., A.R.S.M., F.R.S.C.,

Professor of Metallurgy,

McGill University.

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LETTER OF TRANSMITTAL.

The Honourable William Sloan,
Minister of Mines of the Province of British Columbia,
Victoria, B.C.

Sir,—After preliminary correspondence in January and February of the present year, I received a letter from Mr. Wm. Fleet Robertson, dated May 18th, in which he asked whether I could make an investigation of the feasibility of smelting your magnetite ores in electric furnaces, provided that certain information, such as the quantity, quality, and cost of the iron ores available, were furnished to me. I replied by telegram and letter of May 26th, offering to undertake the investigation, and received a telegram from Mr. Robertson, dated May 30th, instructing me to proceed with the investigation.

Mr. Robertson's telegram was confirmed by a letter dated June 20th from the Provincial Secretary, informing me that I had been appointed by His Honour the Lieutenant-Governor in Council to carry out the investigation; my appointment dating from June 5th.

I left Montreal on June 5th, reaching Victoria on June 10th, and devoted myself to the inquiry from that date until July 13th, when I left Vancouver for Montreal. This time was spent mostly in Victoria and Vancouver, but fourteen days were occupied in a visit to San Francisco and Heroult, California, for the purpose of ascertaining the progress that had been made in the electric smelting in that locality. I also visited Nanaimo, at your request, to inspect a process for the production of charcoal.

A supply of cheap electric power is an essential condition for the electric smelting of iron ores, and I made careful inquiries with regard to this. The power companies in Vancouver were unable, during my visit, to give me definite information on this point, but I understood that power could probably be provided at about $15 per electrical horse-power year; a price at which it seemed possible that electric smelting could be undertaken commercially.

On this understanding I made a thorough investigation of the other elements of cost and of the most efficient methods for smelting iron ores under the conditions existing in British Columbia, and came to the conclusion that electric smelting would be possible under these conditions.

On September 19th, when my report was nearing completion, I received a letter informing me that the charges for electric power would be nearly twice the figure I had assumed in my calculations. This change not only alters very greatly the cost of pig-iron obtained by electric smelting, but has caused a radical alteration of the character of my report. Under this changed condition the electric smelting of iron ores by existing methods is scarcely possible, and the only remaining opening, unless cheaper power can be obtained, is by developing a new process, which has lately come to my notice, and which appears to be more economical than the usual methods of electric smelting. The possibility of the electric smelting of iron ores in British Columbia, using power from the present sources of supply, would seem to depend on the successful development of this new process.

I beg to submit herewith the report of my investigation.

I have the honour to be,
Sir,
Your obedient servant,
Alfred Stansfield.

McGill University, Montreal, November 11th, 1918.

INTRODUCTORY.

EXTRACTS FROM CORRESPONDENCE RELATIVE TO THE INVESTIGATION.

DEPARTMENT OF MINES,
OFFICE OF PROVINCIAL MINERALOGIST,
VICTORIA, B.C., May 18th, 1918.

Dr. Alfred Stansfield,
McGill University, Montreal, P.Q.

DEAR DR. STANSFIELD,—I am instructed by the Honourable the Minister of Mines, the Hon. William Sloan, to say that at last matters have come round so that he can see his way to go ahead with the investigation of the commercial feasibility of the smelting of our magnetites in an electrical furnace, and he has asked me to find out if you are still open to engagement for such purpose this summer.

His idea is that we can provide you with all requisite data as to quantity and quality of ores available, costs of delivering same at any given point, all analyses of ores and fluxes, cost of labour by day, etc., fuel, quality, and costs.

On this data, so provided you, you could base your calculations and conclusions, and your responsibility would not extend back of the data so provided.

You would further not be required to go into the question of market. It seems to me that this would greatly lessen the work expected of you and your responsibility, taking much less time.

If you are still open to make investigation, I would be obliged if you would telegraph the Minister or myself to that effect. . . . It would, of course, be very desirable that you came out here and looked over the ground for yourself and indicated to us in advance just the data you would require to be provided with.

I am,
Yours very truly,
(Signed.) WM. FLEET ROBERTSON,
Provincial Mineralogist.

DEPARTMENT OF METALLURGY,
MCGILL UNIVERSITY, May 26th, 1918.

William Fleet Robertson, Esq.,
Provincial Mineralogist, Victoria, B.C.

DEAR MR. ROBERTSON,—I am much obliged for your letter of the 18th, which reached me on Saturday morning, the 25th. . . . I consider that on the basis outlined in your letter I could make a satisfactory report to the Government on the feasibility of smelting the British Columbia magnetites in electrical furnaces. . . .

I expect to be in New York on June 1st, but I could leave Montreal for the West on the 3rd, and suppose that I should go in the first place to Victoria to confer with yourself and others having information bearing on the subject, to collect all the information available at that point and perhaps to visit some probable location for the smelter.

I have been making inquiries with regard to the progress of the electric smelting of iron ores by the Noble Electric Steel Company at Heroult, California, and learn that this has been given up and that the plant is now used for the production of ferro alloys. I am informed that the smelting of iron ores in California has never been commercially successful, due to unsatisfactory commercial conditions. In view of this, it appears to me that most valuable information could be gained if the Government could obtain permission for me to visit and inspect the plant, and to discuss with the management the reasons which led to their want of success. . . .

In a general way I can state in advance:—

(1.) It is unlikely that the electric furnace can be operated in British Columbia, under normal conditions, in competition with the blast-furnace for the production of tonnage iron.

(2.) Conditionally on there being available a sufficient amount of cheap electric power, pure iron ore and charcoal, a moderate output of high-grade iron could probably be made at a profit under normal conditions.

(3.) Under present prices it is possible that ordinary grades of iron could be made at a profit.

It may therefore be that a plant could be started to produce the various grades of iron needed at present, and that later, when the price of iron comes down again, the whole production could be put into special-quality iron.

I may add that I have learned recently of a new process which may have an important effect on the electric smelting of iron ores. . . .

I remain,

Yours very truly,

(Signed.) ALFRED STANSFIELD.

AN ACCOUNT OF THE INVESTIGATION.

On my arrival in Victoria on June 10th, I was met by Mr. Wm. Fleet Robertson, and on the following day I had an interview with yourself with regard to the scope of the investigation.

While in Victoria Mr. Robertson and Mr. William Brewer furnished me with information for my report, chiefly with regard to the amount and nature of the available deposits of iron ore, and the probable cost of mining these ores and shipping them to a point at which a smelter could be located. Mr. Robertson also obtained for me a memorandum from the Department of Labour with regard to the supply, nature, and cost of labour in British Columbia. I have consulted Mr. Robertson with regard to the greater part of the investigation, and he has assisted me throughout in obtaining the information needed for my report.

With respect to the supply of electrical power, I had interviews with Mr. J. F. Halls, Mr. Eastman, and other officials of the British Columbia Electric Railway Company in Victoria, and later, in Vancouver, with Mr. George Kidd, General Manager of this company, and Mr. R. F. Hayward, General Manager of the Western Electric Power Company of Canada. I also met Mr. J. M. Savage and Mr. Thomas Graham, of the Canadian Collieries, Limited, with regard to electric power at Comox. Before leaving the Coast I consulted Mr. William Young, Comptroller of Water Rights, and Mr. H. K. Dutcher, of Vancouver, with regard to undeveloped water-powers of British Columbia and the cost of obtaining from them a supply of electric power for smelting.

In Vancouver I met Mr. Giles, General Manager of the Vancouver Engineering Works, and discussed with him the requirements of the district in respect of pig-iron and steel. I attended a meeting of the Vancouver Metal Trades Association, and met Mr. A. B. Weeks, General Manager of the Canadian North-west Steel Company, Mr. G. G. Bushby, and Mr. J. Hart, the Secretary of the Metal Trades Association. I called upon and corresponded with Mr. Nichol Thompson with regard to the supply of iron ores and coal and the local markets for pig-iron and steel. I had an interview with Mr. Murray, of Messrs. Evans, Coleman & Evans, in regard to the consumption and price of pig-iron and steel in Vancouver and district.

I met Mr. R. H. Tudhope, Mr. G. R. Grant, and Mr. Renton, of the Turnbull & Tudhope Engineering Syndicate, and visited their plant at Port Moody, where pig-iron was being made from steel scrap in an electric furnace. I obtained from these gentlemen valuable information in regard to the operation of electric furnaces in the district, and have also corresponded with Mr. Turnbull on this subject.

With a view to obtaining a supply of charcoal, I had interviews with Dr. J. R. Davidson, of the University of British Columbia, and visited with him a Vancouver sawmill and the charcoal plant of the Electric Turpentine Syndicate. I also interviewed Mr. Walter Thomas and his partner in Vancouver in regard to his processes for making charcoal, and visited, with Mr. Thomas and Mr. Brewer, the experimental plant at Nanaimo, where Mr. Thomas's process for coking coals has been tested. I also consulted Mr. Tudhope, Mr. Grant, and Mr. Herbert Carmichael in regard to the production of charcoal. While in Victoria I called on Mr. L. B. Beale, of the Forestry Department, with reference to the supply of timber for charcoal-making, and since returning to Montreal I have obtained information and other assistance from Dr. Bates, Superintendent of the Forest Products Laboratories, and have myself prepared some charcoal from a sample of Douglas fir.

I visited San Francisco in order to meet the Noble Electric Steel Company. I saw Mr. H. H. Noble, the President, and also Mr. W. H. French, the Vice-President, with whom I visited the company's plant at Heroult, in Shasta County. While in San Francisco I met Mr. J. W. Beckman and Mr. H. E. Linden, of the Beckman & Linden Engineering Corporation, and visited an electric-smelting plant at Bay Point, California, which has been erected and operated by that corporation for the Pacific Electro Metals Company. Messrs. Beckman and Linden have supplied me with an estimate of the cost of constructing and operating a similar plant arranged for the electric smelting of iron ores.

The B. L. Thane Construction Company, of San Francisco, have made a very extensive investigation of the supplies of iron ore and coking-coal on the Pacific Coast with a view to the establishment of a large iron and steel plant. Mr. Thane and Mr. F. B. Hyder very generously put at my disposal a large amount of information on this subject. I am also indebted to Mr. T. A. Rickard, Editor of the *Mining and Scientific Press*, and to Dr. L. H. Duschak, of the United States Bureau of Mines, whom I met in Berkeley, California, and to Mr. W. van Winkle, of San Francisco, for important help in my inquiry. While at Heroult I met Dr. Trood and Mr. W. A. Darrah and learned of their work on the reduction of iron ores.

Mr. R. H. Stewart, of Vancouver, helped me in regard to the engineering aspects of the report and furnished me with certain cost data in respect to the construction of an electric smelting plant in British Columbia. I am indebted to Professor E. T. Hodge, of the University of British Columbia, and to Mr. E. A. Haggan, Editor of the *Engineering and Mining Record*, for assistance in my inquiry.

In San Francisco I met Mr. Davis and Mr. M. H. Schnapp, of the General Electric Company. In Vancouver I met Mr. H. Pim, Manager of the Vancouver office of the Canadian General Electric Company, and I have corresponded with their head office in regard to electrical equipment.

I wish to express my indebtedness to all the gentlemen named above as well as to some others who have helped me in obtaining the very varied lines of information that are essential for the preparation of even a preliminary report on so complex and difficult a subject.

After concluding my investigation on the Coast, I left Vancouver on July 13th, arriving in Montreal on the 18th. Since that time I have been occupied with the preparation of my report.

While in British Columbia I endeavoured to obtain from the power companies some definite assurance with regard to the price at which power could be supplied to an electric-smelting plant. It was not, however, until September 19th, when my report was nearing completion, that I received a letter containing the terms on which power could be obtained.

INTRODUCTION TO THE REPORT.

The object of this investigation and report is to determine the commercial feasibility of smelting electrically the magnetite ores of British Columbia.

For this purpose I obtained information with regard to the supply of iron ores, electrical power, charcoal, labour, and other necessaries.

Early in the investigation it appeared that electric power might be obtained at such a price that electric smelting by the methods now in use would be commercially possible. I therefore investigated and discussed carefully the type of furnace and design of plant that would best suit the local requirements, and prepared estimates for the cost of such a plant and of making pig-iron on a scale determined by the present requirements of the Province. It now appears that electric power cannot, at present, be obtained at prices that will permit of the use of the usual electric smelting methods; but I am presenting the results of my investigation along these lines because they are needed to show that the process described would be too costly with power at this higher price, and because it is possible that, in the future, power may be available at a lower price, which would then permit of operations being undertaken.

In view of the very high price asked for electric power, I have paid special attention to a new process for producing electric furnace iron which offers possibilities of a decided economy as compared with standard methods. I have presented the available information and made estimates of the cost at which iron may possibly be smelted by these means.

The whole investigation is necessarily very extensive, and it is a matter of some difficulty even to present the results in a clear and simple manner, especially as each conclusion arrived at is dependent on a number of factors which cannot be stated in a few words, and many of which are liable to change. The information obtained is set forth and discussed in detail in a number of Appendices; while the conclusions arrived at are presented as concisely as possible in the following report.

ELECTRIC SMELTING OF IRON ORE.

This has passed the experimental stage and is in operation commercially on a large scale in Sweden and elsewhere. The product of this operation is a special quality of high-grade iron which commands a higher price than ordinary blast-furnace iron, and the cost of production is in general too high to allow of competition at equal prices with the blast-furnace product. Carbonaceous material is needed, even in electric furnaces, for reducing the iron ore to metal, and for this purpose charcoal is preferable and is generally used. The electric furnace that has been adopted for the commercial smelting of pig-iron is that of Messrs. Electro-Metals, Limited, of Sweden, which may be regarded as the standard. The pig-iron normally produced from this furnace, although unusually pure and commanding a high price, is a white or low-silicon iron, unsuitable for use in the iron-foundry. The officials of the Swedish company consider that a foundry iron can be made by these furnaces, though at a somewhat higher cost, but I have no evidence that this has been accomplished in regular commercial practice, and the Noble Electric Steel Company, which smelted iron ores electrically for several years at Heroult, in California, was obliged to adopt a different type of furnace for the production of foundry iron. I consider, however, that the Electro-Metals furnace could be used for this purpose because any low-silicon iron could be made suitable for foundry use by additions of ferro-silicon; but considerations which will determine the best type of furnace for use in British Columbia are given later in the report.

FACILITIES FOR ELECTRIC SMELTING IN BRITISH COLUMBIA.

The essential conditions for the electric smelting of iron ores on a commercial scale are: A supply of high-grade ores at a reasonable price, an ample supply of cheap electric power, a supply of charcoal or other fuel at a moderate price, a supply of labour at a moderate price, a suitable location for the smelting plant, and a sufficient market for the resulting iron at a rather high price. The situation in British Columbia may be considered under these separate heads as follows:—

Iron Ores.

The information furnished to me by your officials shows that the iron-ore deposits of the Province have not been opened up to any extent, but that it is safe to assume that adequate supplies of ore of reasonable richness and purity can be obtained at easily accessible points. These ores are chiefly magnetites, and on this account are undesirable for use in the blast-furnace except in admixture with other ores; magnetites are, however, quite suitable for treatment in the electric furnace. It appears that the ores are not of very high grade, but that a supply may be expected to contain from 50 to 55 per cent. of iron. The ores are practically free from phosphorus and titanium, and the proportion of sulphur can probably be kept as low as 0.1 per cent. The ores under consideration are also practically free from copper. Your officials estimate that a supply of 50,000 tons per annum of ore of this grade can be delivered at a suitable smelter-site at a cost, under present conditions, of about $4 per net ton, which would be made up as follows:—

Mining	$1.50 to $2.00
Loading or tramming	.15 to .25
Freight (by water)	1.00 to 1.50
Unloading	25 cents
Royalty to owner*	50 cents
Total cost at smelter	$3.96 to $4.10

From the information at my disposal, I feel satisfied that these ores can be smelted electrically for the production of a high-grade pig-iron. For the production of one long ton†

* Using a royalty in this estimate removes the need of considering the purchase of an iron-mine.

† *Long and Short Tons.*—Pig-iron is sold by the long or gross ton of 2,240 lb. not only in England and Canada, but in the United States, and I have conformed with this custom in my report. The supplies needed for smelting, such as iron ore, charcoal, coal, and coke, are sold in British Columbia by the short or net ton of 2,000 lb., and the use of this dual system has necessarily complicated the calculations in this report. The situation is further complicated because, in Government reports, pig-iron is estimated by the short ton, and in regard to pig-iron quotations in British Columbia it is sometimes difficult to say which ton is intended. In sweden a more consistent system is followed, as the pig-iron and all the necessary supplies are measured by the metric ton of 1,000 kilograms, or 2,204 lb. This ton, which may be assumed in all statements of the Electro-Metals Company of that country, can be taken without serious error to be the same as the long ton.

of pig-iron about 2 net tons of 55-per-cent. ore would be needed, so that the ore would cost $8 per long ton of pig-iron. In view of the somewhat low grade of the ore, the cost of smelting per ton of product will be rather higher than is usual with the Swedish ores, but this may perhaps be remedied by the use of magnetic concentration.

ELECTRIC POWER.

British Columbia is well provided with water-powers, and many of these can be developed cheaply for the use of electric-smelting and similar industries. Competent engineers have assured me that some of these powers in accessible locations can be developed at such a cost as to yield a continuous electrical horse-power for smelting at a cost of $10 per annum. This figure is not much higher than obtains in Sweden, and if a dependable supply of power can be secured at this rate it seems almost certain that an electric-smelting industry can be undertaken profitably. The consumption of power, under conditions obtaining in British Columbia, would be between 0.4 and 0.5 of a horse-power year per ton of iron produced; so that the cost for power should be between $4 and $5 per long ton of pig-iron. Some 8,000 or 9,000 horse-power would be needed for a daily production of 50 tons of pig-iron.

In view of the desirability of producing pig-iron at the earliest possible time, and of the difficulty and expense attending the development of water-powers under present conditions, it is highly desirable, if not imperative, that an electric-smelting industry shall be supplied, in the first place, from powers that are already developed. The British Columbia Electric Railway Company has surplus power which might be employed for this purpose, and I gathered from the officials of this company that they could possibly supply such power at $15 per horse-power year, a charge which appeared to me to be the highest that the industry could support. Under these conditions the cost for power per ton of pig-iron would be between $6 and $7.50.

Since returning to Montreal I have received a letter, dated September 12th, from the general manager of this company, informing me that conditions have changed since my visit, and that they would now have to charge higher rates. They would be willing to make short-term contracts for from 2,000 kw. to 10,000 kw. of electric power in Vancouver District for restricted service during the peak-load periods at a rate of 0.5 cent per kilowatt-hour. This charge would amount in effect to at least $27.80 per horse-power year and would represent a charge of from $11 to $14 per ton of iron. They would also offer 2,000 kw. of power on Vancouver Island at $15 per horse-power year for a short term and subject to peak-load restriction. The proposed charge in Vancouver is, I believe, altogether too high to allow of the commercial production of pig-iron by present methods, except perhaps on a small scale as a temporary operation to take advantage of the present high price of pig-iron. The supply on Vancouver Island, besides its uncertainty, is too small to permit of profitable operation.

CHARCOAL AND COKE FOR REDUCTION.

For the electric smelting of iron ores a supply of carbonaceous material is needed for reducing the iron ore to metal. For this purpose charcoal is generally used, although coke is employed to some extent. Charcoal is preferable to coke on account of its greater purity, as a higher grade of pig-iron can be obtained by its use. The use of charcoal is more satisfactory also from an operating point of view, and the consumption of power is greater when coke is employed; a proportion of coke can, however, be used without difficulty in admixture with charcoal. The consumption of charcoal varies with the grade of iron required, and the type of furnace employed, from about 0.4 to 0.5 net tons of charcoal per long ton of pig-iron, so that 20 or 25 tons of charcoal would be needed daily for an output of 50 tons of pig.

In the Coast districts of British Columbia there is an abundant supply of timber from which charcoal can be made suitable for use in electric smelting. At present there is no considerable charcoal industry, and the small quantities now obtainable cost as much as $30 per ton, a figure which would be prohibitive for the electric smelting of iron ores. In view, however, of the large amount of waste wood produced at some of the large sawmills, it appears reasonable to suppose that a well-designed charring plant can be erected that would utilize this waste material and deliver charcoal to the smelter at a cost of from $6 to $8 per net ton; estimated on the following basis:—

2½ cords of Douglas fir mill-waste	$2 50
Cost of charring, less returns for by-products	2 50
Carriage of charcoal to smelter	1 00
Total	$6 00

The charge per ton of iron would thus be between $2.40 and $4.

With regard to the method to be employed, it may be stated briefly that the Douglas fir, which would probably constitute the staple supply for charcoal-making, does not furnish by-products of suitable quality and quantity to warrant the use of elaborate methods for their recovery. Charcoal should therefore be made in large kilns, or in some appliance which might be devised to char the wood-waste with the minimum amount of hand-labour; in either case a partial recovery of by-products could be made at a moderate expense.

It does not appear that coke can be produced from British Columbia coals at a price that would be as low as that of charcoal; and unless the coke was decidedly the cheaper per ton it would be more economical to use charcoal. Coke breeze, however, can probably be obtained for a very nominal charge, and can be used in admixture with charcoal in cases where extreme purity of the pig-iron is not desired.

Labour.

The Department of Labour has furnished me with a statement of the supply, nature, and cost of labour in British Columbia, from which it appears that labourers are fairly plentiful and receive nearly $4 a day, and that most skilled men are scarce at about $6 a day. The cost of labour per ton of product will depend very largely on the size and output of the plant and the nature of its equipment; but it appears that in a fully equipped plant making about 50 tons of pig-iron daily, besides steel and ferro-alloys, the cost of labour might be from $4 to $5 per ton of iron; although in the initial stages the labour cost would certainly be higher, perhaps in the order of $7 per ton of iron. The manner in which these figures are arrived at is stated in the Appendices.

Location for Smelting Plant.

A plant for the electric smelting of iron ores should be conveniently situated with respect to the supplies of ore, charcoal, and other requirements; it should also permit of cheap delivery of the iron and other products to market. The plant must be placed as close as is convenient to the source of electric power, so as to lessen the cost of transmission. When a satisfactory supply of power has been secured, it will doubtless be possible to obtain a smelter-site within a reasonable distance of the power-station and located on tide-water, so as to provide for cheap delivery of supplies and products. A plant located near a centre of population, such as Vancouver, would have advantages with respect to labour and general supplies and nearness to markets, but the provision of an adequate and cheap supply of electric power, iron ore, and charcoal should be the determining consideration.

Market for Pig-iron.

For the purpose of this report I have limited my investigation to the market in British Columbia itself, though a moderate export market may be developed later. The present consumption of pig-iron is only about 10 tons daily, but it appears that the consumption has been seriously limited by the extremely high prices now ruling, and that if a supply of iron becomes available at a moderate price a consumption of 20 or 30 tons may be expected. This amount is too small to permit of economical operation, and I would therefore recommend, if a suitable supply of electric power can be obtained, that a plant be constructed to produce, say, 25 tons daily of foundry iron for sale and a further 25 or 30 tons of low-silicon iron for conversion into steel. I have not investigated the market for steel in any detail, but apparently a sufficient market for this product could be found.

The prices of foundry iron in Vancouver have varied recently from about $60 to $80 per long ton. Before the war the price was around $25. It seems unlikely that the price for good foundry iron will fall much below $35 a long ton during the next few years. In most localities electric smelting depends for its commercial possibility on obtaining for its product a higher price than that of ordinary foundry iron. I find that at present there is scarcely any demand

in British Columbia for such special grades of iron, but there can be no doubt that they will be needed in the future, as the iron and steel industry develops.

FOREIGN COMPETITION.

The market prices already mentioned as obtaining in British Columbia are based on the present sources of supply from Eastern points in Canada and the United States. It is possible that an iron blast-furnace plant may be established on the Pacific Coast of the United States, and the effect of this on the market in British Columbia must be considered. It appears that pig-iron could be made in such a plant at a cost of about $25 per long ton under present conditions. The duty on pig-iron entering Canada from the States is $2.80 per long ton plus 7½ per cent. *ad valorem*, which at a sale price of $30 per ton would amount to $2.25 per long ton, or a total charge of about $5. This duty, together with the freight charge and the Canadian bounty, would place the electric-furnace iron, if made with $15 power, on an equality with imported blast-furnace iron. This would not hold, however, in the case of iron imported for war-work, as this is duty free, and after the war the duty of 7½ per cent. *ad valorem* will no doubt be removed. In this connection it may be added that a large iron and steel plant can scarcely be built until some years after the war, so that an electric-furnace plant, if constructed promptly, would command the market for a number of years. Ultimately, blast-furnace iron may be expected to take a part at least of the market for common grades of iron, but the electric furnace should always be able to command a small market for its higher grade of iron.

ARRANGEMENT WITH THE DOMINION GOVERNMENT.

A deputation from British Columbia went to Ottawa early in the present year, seeking for aid to develop an iron industry in British Columbia. In answer to their request, the Dominion Government undertook for a period of years to purchase, if necessary, at market prices, the whole output of a plant making pig-iron in British Columbia. Your Department was unable at the time of my visit to give me the exact text and meaning of the arrangement, but was to obtain further information from Ottawa. This agreement will no doubt apply equally to electric-furnace iron, but it does not appear to me that it is likely to help matters materially, for the following reasons:—

(1.) The offer is obviously of no use if the price referred to is that obtaining in Eastern Canada, as iron could not be made at that price.

(2.) If the price intended is the local price in British Columbia, we are met with the difficulty that the Government's ability to carry out the undertaking would be limited to the local demand for iron, as it would be impossible for it to buy expensive iron in British Columbia and ship it to lower-priced markets elsewhere. We are thus limited to the natural market for iron and steel in British Columbia and to possibilities for exportation on a small scale.

BOUNTIES AND TAXES.

The Provincial Government has offered a bounty of $3 per net ton of pig-iron made in British Columbia from local ores, and, on the other hand, imposes a tax of 37½ cents per net ton of iron ore mined. The combined effect of these measures will be a payment of about $2.60 per gross ton of pig-iron; a source of income which will be of some importance, and may sometimes make the difference between operating at a loss and at a profit.

TYPE OF FURNACE TO USE FOR ELECTRIC IRON-SMELTING.

A point of considerable importance to this investigation is the determination of the most suitable type of electric furnace. This is important not only for the guidance of those who may undertake the establishment of an electric-smelting plant in British Columbia, but also in order to arrive at reasonably accurate figures for the cost of the plant and the cost per ton of the products. In outline the situation is substantially as follows:—

(1.) In Sweden the firm of Electro-Metals (of Ludvika and London) has developed a type of electric-smelting furnace which has proved very satisfactory for the production of low-silicon pig-iron from the Swedish ores. There are now seventeen of these furnaces at work in Sweden, ranging in size from 2,000 kw. to 5,000 kw., and a few in Norway, Switzerland, and Japan. This is, as far as I am aware, the only type of electric furnace that has ever attained commercial success in the production of pig-iron from iron ores.

The furnace is circular in plan and is provided with a tall stack, in which the ore is preheated and partially reduced before it enters the smelting-chamber. This reduction of the ore is aided by a mechanical circulation of the furnace gases, which are withdrawn from the top of the shaft, freed from dust, and then blown through tuyeres into the smelting-chamber above the ore. The gases become heated at this point, and passing up the shaft they heat and reduce the ore. The circulation of the gases also serves to cool and protect the arch of the smelting-chamber, but, on the other hand, it increases slightly the consumption of the electrodes.

On account of these special features the Electro-Metals furnace uses somewhat less charcoal than a simpler type of furnace, a difference of, say, one-tenth ton per ton of pig-iron, and it is believed to use less power. The saving in charcoal is probably more than offset by the need of a better quality of charcoal, which is rendered necessary by the use of a tall shaft. It must be noted, however, that the usual product of the Electro-Metals furnace is a white pig-iron suitable for chilled castings or for steel-making, while the need in British Columbia would be largely for a foundry iron. There does not appear to be any evidence that the Swedish furnaces have been used regularly for the production of foundry iron, and there seems to be some doubt regarding their suitability for this purpose.

(2.) An independent development of electric iron-smelting took place at Heroult, Shasta County, California, where a deposit of very pure magnetite has been smelted electrically by the Noble Electric Steel Company for the production of foundry iron. Operations were started in 1907 by the late Dr. Heroult, who built a simple rectangular furnace having an arched roof, and ore-chutes in which the charge could be preheated. As this furnace did not prove satisfactory, a shaft-furnace of the Swedish type was tried. This was also unsatisfactory, and the management reverted to the rectangular type with arched roof and with charging-chutes, in which, however, the ore was not preheated. It was claimed at the time (1913) that success had been obtained with this furnace, but nothing further was published about it, and I find that its use was discontinued about four years ago. The plant is at present employed solely for the production of ferro-alloys, because the price now charged for electric power, the cost of charcoal, and the cost of transportation are all so high as to render impossible the commercial production of pig-iron. I am of the opinion that we cannot accept the work at Heroult as an argument for or against the type of furnace that was used there.

(3.) Another furnace of the closed rectangular type was devised by Helfenstein for the production of calcium carbide and ferro-silicon. A Helfenstein furnace for smelting iron ores was being tried at Domnarfvet, in Sweden, at the time of my visit in 1914. At that time the management was unwilling to give any information about its operation. An account published a year or two later stated that this furnace was working satisfactorily, but Messrs. Electro-Metals now inform me that "the furnace was found quite useless and has been pulled out."

(4.) For the production of ferro-silicon, ferro-manganese, and calcium carbide a simple rectangular open-topped furnace has been developed, and is in use at many places. In this furnace no attempt is made to preheat the ore, and the gases produced in the furnace escape and are lost, besides creating a nuisance by burning above the furnace. On the other hand, the furnace is easy to build, simple to operate, and is probably not far inferior to the Swedish furnace in commercial efficiency. I am not aware that this furnace has been used commercially for making pig iron, but there can be no doubt that pig iron of any desired variety could be made in it. The Beckman and Linden Engineering Corporation of San Francisco, who are using it for ferro-manganese, consider that it would be preferable to the Swedish furnace for making pig iron, and that it would be little if any inferior in point of economy.

Conclusions.—(1.) If a permanent smelting plant were being erected, the Swedish type of furnace would be selected, because it is more economical than any other at present in use, and is the only one that has been employed commercially.

(2.) If a temporary plant is contemplated, it may be better to install the open-pit furnace, on account of its smaller first cost and the ease with which it could be converted to other uses.

(3.) Information should be obtained with regard to the iron-ore reduction process of Trood and Darrah, as this may prove superior to any direct smelting process. If this process is likely to be available, it will be best in the meantime to use a simple pit-furnace rather than to install the more elaborate Swedish furnace.

Further particulars in regard to the two types of furnace will be found in Appendix VIII.

COST OF PRODUCTION.

In order to arrive at an approximate estimate of the cost of smelting iron ores, it is necessary, in the first place, to decide upon the scale of operation. In view of the local market and other considerations, which I discuss elsewhere, I suggest the following equipment as being suitable for an electric-smelting plant in British Columbia, providing that the usual electric-smelting methods are adopted:—

OUTLINE OF PLANT.

One electric-smelting furnace of 3,000 kw., making daily about 25 tons of foundry iron for sale.

One electric-smelting furnace of 3,000 kw., making about 30 tons of low-silicon iron for conversion into steel.

Three electric furnaces of 300 kw. each, making together about 3 tons of ferro-alloys.

Two electric steel furnaces of 1,500 kw. each, making together about 50 tons of steel.

Steel foundry and rolling-mill using 50 tons of steel daily.

COST OF PLANT.

The design and cost of such a plant is discussed in the Appendix. As, however, it would be very difficult to use so complicated a plant as a basis for estimating cost of making pig-iron, I shall consider for this purpose a plant of about equal size devoted entirely to the production of foundry iron. In so doing I am making the assumption, which will not be very far wrong, that the cost of making pig-iron in the simple plant will afford a fairly correct idea of the cost of making it in the complex plant, outlined above, which would be suited to the local requirements.

The simple plant, assumed for purposes of calculation only, would consist of three electric-smelting furnaces of 3,000 kw. each, producing altogether about 80 tons of pig-iron daily.

The cost of such a plant and of smelting iron in it will depend on the type of furnace employed. The most economical furnace, as far as my information goes, is that of the Electro-Metals Company, and I give in the first place an estimate based upon its use.

An electric iron-smelting plant of this type, containing three 3,000 kw. furnaces, would cost from $350,000 to $400,000 to erect in British Columbia (details are given in the Appendix), and should have a production of 27,000 long tons of foundry iron per annum.

COST OF ELECTRIC SMELTING.

The cost of making a long ton of foundry pig-iron in such a plant would be estimated as follows, assuming that power can be obtained at $15 per horse-power year:—

Smelting in Swedish Furnace with $15 Power.

Iron ore, 2 net tons at $4	$ 8 00
Electric power, 0.45 horse-power year at $15	6 75
Charcoal, 0.4 net tons at $8	3 20
Electrodes, 15 lb. at 8 cents	1 20
Repairs and maintenance	1 00
Labour	4 50
Management	2 00
Interest, 6 per cent. on total capital, and depreciation, 10 per cent. on cost of plant	2 60
Royalty to Electro-Metals Company	50
Total	$29 75

If power could be obtained at $10 per horse-power year, the charge for this item would be $4.50 and the total cost of a ton of pig-iron would be $27.50.

If power were to cost 0.5 cent per kilowatt-hour, the charge for power would be about $12.50 and the total cost of a ton of pig-iron would be $35.50.

In regard to these figures, it should be stated that the Electro-Metals furnace is a somewhat elaborate appliance, and that a plant with furnaces of this type should not be constructed unless

a permanent supply of cheap power can be assured. This is not so much because of the cost of construction, which may not be much more per ton of yearly product than that of a plant with the simplest type of furnace, but because the furnace, and the building containing it, are entirely specialized, and would be of no use for any other purpose. If for any reason it should be decided to erect a plant with an expensive or a temporary source of power, it would be desirable to arrange for a plant of the type in use for making ferro-alloys, as the furnace, and plant generally, could readily be converted to other purposes if at any time it became inadvisable to make pig-iron. With this simpler type of furnace the cost of making pig-iron would probably be about $5 higher per ton than the above estimates; thus the cost of a ton of pig-iron would be $35 per ton if power costs $15 per horse-power year, and would be more than $40 per ton with power costing 0.5 cent per kilowatt-hour.

The following table will give an idea of the distribution of costs under these conditions:—

Smelting in Simple Furnace with 0.5-cent Power.

Iron ore, 2 tons at $4 per ton	$ 8 00
Electric power, 0.5 horse-power year at $27.80	13 90
Charcoal, 0.5 ton at $6 per ton	3 00
Electrodes, 20 lb. at 8 cents per pound	1 60
Repairs and maintenance	1 00
Labour	6 00
Plant and general office expenses	4 00
Interest and depreciation	3 00
Total	$40 50

The prices obtained for pig-iron in British Columbia during the last year or two have been considerably higher than this, but it does not seem safe to count on a price of more than about $35 a ton during the next few years, so that making iron under these conditions would appear to be out of the question.

MAGNETIC CONCENTRATION OF IRON ORES.

As the cost of smelting iron ore is greater per ton of the product with poor ores than with rich ores, and as the ores in British Columbia are only expected to contain 50 to 55 per cent. of iron, with about 23 to 30 per cent. of gangue, it is worth considering whether it will pay to concentrate the ore preparatory to smelting.

Until adequate samples of the ores have been obtained, analysed, and submitted to magnetic concentration, it is impossible to discuss this subject except in general terms.

(1.) If the ore is of such a nature that after breaking down to a size of about 1 inch the ore can be concentrated magnetically so as to reject a large part of the gangue, it will usually pay to do this before smelting.

(2.) If the ore is so firmly grained that it is necessary to crush it to a sand before magnetic dressing, there will be involved the cost of the fine crushing and also the cost of briquetting or sintering the concentrates to make them suitable for smelting.

(3.) In the case of an ore that does not contain over 50 per cent. of iron, if the ore lends itself readily to magnetic concentration so that very fine grinding is unnecessary and a clean separation can be obtained, the saving in the cost of smelting will probably pay for the cost of crushing, magnetic dressing, and sintering with sawdust on a Dwight-Lloyd machine. The ore will incidentally be improved by the removal of phosphorus and sulphur, and will be left in a condition more favourable for smelting.

(4.) If preliminary reduction of the ore is employed, the ore will have to be crushed to a coarse powder, and magnetic concentration will then form an essential step in the process; being applied either before or after the reducing operation.

AUXILIARY INDUSTRIES.

On account of the limited market for pig-iron in British Columbia, it will be impossible to conduct at a profit a plant producing nothing but pig-iron. By including in the plant the production of steel and ferro-alloys the plant will be more likely to pay.

STEEL.

In view of the small size of the industry, it will be out of the question to attempt to roll large plates for ship-building or large structural sections or rails, but small sections and bars of structural steel can be rolled, besides bars of cast steel for drills and similar purposes. Steel will also be needed for the production of steel castings.

The steel can be melted in an open-hearth or an electric steel furnace, using, as stock, steel scrap and white pig-iron from the electric-smelting furnace. If it is desired to charge the pig-iron in the molten state, so as to save the cost of remelting, a "mixer" will be needed to keep the iron molten until it is needed. As the iron ore is low in phosphorus, the iron will be of "Bessemer" quality and an acid-lined furnace will be satisfactory for steel-making. A small rolling-mill and a steel-foundry will form necessary adjuncts of the plant. Further particulars are given in Appendix XIII.

FERRO-ALLOYS.

The production of these alloys would form a simple and profitable part of the work of such a plant. The alloys that would probably be made are ferro-manganese, ferro-chrome, and ferro-silicon. The essential ingredients of these are manganese ore, chrome ore, quartz, scrap-iron or iron ore, and charcoal or coke. All these are available, and these alloys can be made in the small 300-kw. single-phase furnaces mentioned in the design. Information with regard to the supply of manganese and chrome ores and the methods and costs of making ferro-alloys will be found in Appendix XIII.

A NEW METHOD OF PRODUCING ELECTRIC-FURNACE IRON.

It has been pointed out that an electric-smelting industry must depend for the present on electric power furnished by the power companies of British Columbia. It has also been stated that the company best able to supply power has asked so high a price that the commercial production of pig-iron by electric smelting seems to be impossible. Under these conditions it would appear that nothing can be done except to wait for cheaper power or to make a little pig-iron as a part of some more remunerative operation.

There is, however, in view at the present time the possibility of an entirely different method, which may possibly enable iron and steel of electric-furnace quality to be produced at a decidedly lower cost than that of direct smelting in the electric furnace. According to this method, the iron ore would be crushed to a coarse powder, the gangue removed by magnetic concentration, and the nearly pure iron mineral exposed to reducing gases or carbonaceous reducing materials, at moderate furnace temperatures, until the grains of iron ore are converted into grains of metallic iron. This grain metal can then be melted in electric furnaces, with suitable additions, for the production of both pig-iron and steel. The electric power needed for the final melting of the metallic powder would be less than one-third of that required for smelting the iron ore by existing methods, and it seems quite possible that the preliminary reduction of the ore, using waste wood or other cheap fuel, can be effected so cheaply that there will be a substantial saving on the whole process. It will also be noticed that one operation, the conversion of pig-iron into steel, will be avoided by the new process.

This new process was referred to in my letter of May 26th to Mr. W. Fleet Robertson. I had at that time applied to the Advisory Research Council for funds to assist me in investigating the reduction of iron ores, but I have not as yet been able to begin experiments.

During my visit to California I heard of the work of Dr. Trood and Mr. Darrah along similar lines, and I met these gentlemen at Heroult, where I saw in operation a small plant for the reduction of magnetite ore to metallic iron. I am not at liberty to give full particulars of their process, but can state that it consists substantially in heating the coarsely powdered magnetite with charcoal or other carbonaceous reducing material to a temperature of 800° C. for about three hours. In the small plant the heat was supplied electrically, which was more convenient and also permitted of more accurate measurement, but on the large scale it is probable that fuel-heat would be employed. I have received from Dr. Darrah data in regard to the operation, and I have modified these to suit conditions in British Columbia. It will be seen that, even if electrical heat is used for reduction and melting, there should be a decided economy as compared with the direct smelting process.

Cost of One Ton of Reduced Iron (in a Plant making 100 Tons daily).

Ore, 2.2 tons at $4	$ 8 80
Charcoal, ⅓ ton at $6	2 00
Power for heating, 1,380 kilowatt-hours at ½ cent	6 90
Crushing materials, at 50 cents per ton	1 10
Handling materials, at 50 cents per ton	1 10
Labour and supervision	85
Interest and depreciation on an investment of $20,000	25
Total	$21 00

The operation of converting this metallic powder into foundry pig-iron would have to be worked out experimentally, but I believe, with electric power costing ½ cent per unit, and with other supplies at the rates assumed in this respect, that the cost of this operation would be about $10 per ton of pig-iron. The final cost of a ton of iron would therefore be $31, even using high-priced power; and if this figure can be substantiated, it becomes clear that an electric-iron industry can be started in British Columbia under present conditions. I am of the opinion, also, that the electrical power used for reducing the ore can be replaced by ½ ton of coal or similar fuel, or even by waste wood. If this can be done, the charge for heat may be reduced to $2 or $3, and the cost per ton of metallic powder to $16 or $17, so that a ton of foundry pig-iron produced by this process should cost only $26 or $27.

If it is found possible in practice even to approach these estimates, it will be clear that an electric-iron industry can be undertaken immediately in British Columbia and in some other parts of Canada, and that the plants that are now employed for the electric smelting of iron ores may have to be remodelled. I must repeat, however, that although the results indicated appear to me to be very probable, I have not as yet enough information to speak with entire certainty, and further experimental work must be undertaken before it would be safe to proceed to the erection of a plant.

The metallic powder can be made into steel equally easily by melting in electric furnaces, and steel ingots should be produced at a cost only a little higher than that of foundry iron—say, at about $30 per ton. This would render possible a large steel industry in British Columbia.

GENERAL CONSIDERATIONS.

In view of the abnormal prices of products and supplies and the high cost and uncertainty of labour, it is almost impossible at the present time to arrive at any reliable conclusions with regard to the commercial side of a new industry. The high prices obtainable for iron and steel make the present time appear suitable for undertaking the production of these materials, but the increased cost of supplies and of labour largely neutralize this advantage. If it seemed probable that pre-war prices would return in the course of a year or two, we might base our calculations on this assumption; but in view of the profound change that is taking place in the position of labour, it seems unlikely that wages will ever return to their original level. One effect of this will be that the prices of supplies and products will all reach correspondingly higher figures.

If electric power could have been obtained immediately at a reasonable price, it appeared reasonably safe to undertake the electric production of pig-iron by standard methods; but if we are dependent on developing a water-power for this purpose, the delay and the increased uncertainty in regard to costs and prices makes prediction almost impossible. In a general way, however, we may assume that in the course of a few years costs and prices will again reach some steady relationship to one another, and that this relationship will not be very different from what it was before the war.

On this assumption it would seem that, after prices have once more reached a steady level, the electric smelting of iron ores will occupy, commercially, about the same position as before the war, and by considering the condition in Sweden, which resembles Canada in many respects, we can form a fairly good judgment of the possible development of electric smelting in British Columbia.

We may therefore expect, with the present methods of electric smelting, that the industry would be successful commercially, but that it would depend ultimately on the production of special qualities of iron and steel, and would be unable to compete with the blast-furnace in

the production of ordinary grades of pig-iron. If, however, the new process for the reduction of iron ores is found to be satisfactory, it should produce a decided improvement in the commercial status of electric smelting.

CONCLUSIONS IN REGARD TO THE ELECTRIC SMELTING OF IRON ORES IN BRITISH COLUMBIA.

(1.) The three most essential requirements are: Iron ore, electric power, and charcoal or similar material. In the Coast districts of British Columbia there is a sufficient quantity of suitable iron ore conveniently located, water-powers available for the development of electrical energy, and waste wood from sawmills for the production of charcoal.

(2.) Having regard to the present market for pig-iron and the probable price for this material during the next few years, it appears that the iron ore, electric power, and charcoal could be produced sufficiently cheaply for the commercial smelting of iron ores in electric furnaces.

(3.) The development of a water-power is, however, a long and costly operation and one which it would be highly inadvisable to undertake at the present time. For present operations, therefore, we are dependent on the purchase of electric power from the power companies.

(4.) It appears that one of these companies has a sufficient amount of unused electric power, but it is asking a higher price for this power than the industry can bear.

(5.) In view of the original cost of development, it would appear that the company could afford to offer the power at a decidedly lower price, but it should be remembered that the company must keep a reserve of power for other purposes, and that it cannot at present afford to maintain this reserve by undertaking fresh development.

(6.) A new process is now being investigated by means of which it may be possible to produce electric-furnace pig-iron commercially in spite of the high price charged for electric power.

(7.) In view of the small demand for pig-iron in British Columbia, it would be almost essential, if a smelting plant is to be established on an economic basis, that additional products shall be turned out. Steel for castings and small rolled sections, and ferro-alloys, such as ferro-manganese, ferro-chrome, and ferro-silicon, could be made suitably in such a plant. These additional products would permit of more economical operation, would enable larger profits to be made, and would allow the plant to continue in profitable operation if at any time the price of pig-iron were to fall below the cost of production.

(8.) In view of the present situation it appears advisable:—

(*a.*) To develop one or more of the best iron-ore deposits and to make complete tests of the ore:

(*b.*) To reserve a suitable water-power for future development:

(*c.*) To establish a plant for the economic production of charcoal from mill-waste:

(*d.*) To investigate the new process for the production of electric pig-iron, and if this is found satisfactory to begin immediately to produce pig-iron; purchasing power for this purpose until the water-power can be developed.

ALFRED STANSFIELD.

November, 1918.

APPENDICES.

APPENDIX I.

MARKETS FOR IRON AND STEEL.

This subject should be given the first consideration, as we require to know what amounts and varieties of iron and steel can be disposed of, and at what prices they can be sold. This information will determine the scale of the operations, and will have a bearing on most of the other lines of inquiry. There may be available an export as well as a local market, but I have limited my inquiries almost entirely to the market in British Columbia.

Members of the Metal Trades Association, whom I met in Vancouver, and Mr. Giles, of the Vancouver Engineering Works, expressed the opinion that, if pig-iron could be produced locally at a reasonable figure, there would be a market for about 50 tons daily. As iron was selling at $60 to $70 a ton, it appeared that a local iron selling at from $30 to $40 a ton would be able to secure a large market. Mr. Hart, the secretary of the association, tried to obtain from the members individual statements of the amount, quality, and price of their purchases of pig-iron, to form a basis for my investigation; but I have not received any information from him.

Messrs. Evans, Coleman & Evans, of Vancouver, informed me that the consumption of pig-iron in that district was only 3,000 to 4,000 tons per annum, corresponding to 10 tons daily. In view, however, of the fact that Vancouver iron-foundries are now using about 40 per cent. of new pig-iron and 60 per cent. of scrap-iron, whereas normally these figures would be reversed, it appears that the ordinary demand, with iron at a more reasonable price, would be about 20 tons daily.

Mr. Nichol Thompson estimates the market for foundry iron in British Columbia as 10,000 tons per annum, which would be 30 tons per day; and states that in 1912 British Columbia imported over 7,000 tons of pig-iron. These figures are said to be quite apart from the new ship-building industry, which should lead to an expansion in the market for both iron and steel.

In undertaking the smelting of iron ores, it must be remembered that the amount of pig-iron used in foundries for iron castings is far less than the amount which is converted into steel, and therefore, as the market for foundry iron is somewhat limited, we may suitably enlarge the scale of operations by producing some pig-iron for steel-making. An idea of the relative consumption of the several varieties of iron and steel can be gained from the following table, which was sent to me by Mr. John McLeish, of Ottawa, in reply to an inquiry in regard to the market in British Columbia:—

Imports of Iron and Steel Goods from Foreign Countries through Ports in British Columbia and Alberta during Twelve Months ending March 31st, 1915.

Product.	Quantity, Short Tons.	Value.
Pig-iron	2,341.0	$ 27,838
Ingots, billets, and forgings	67.7	4,564
Scrap	262.0	2,700
Cast-iron pipe	1,411.5	41,319
Steel rails and connections	14,993.5	379,134
Angles, bars, plates, etc.	15,394.5	552,939
Tin-plate	8,217.5	621,051
Wire rods, wire, and wire nails	5,404.4	378,076
Nails, rivets, and nuts	402.0	22,712
Chain	205.4	19,385
Car-wheels, anchors, and other manufactures	282.5	17,058
	48,982.0	$2,066,776
Other iron and steel products and manufactures, valued at	...	4,391,955
Total value	...	$6,458,731

The amount of steel produced from a ton of pig-iron depends to some extent upon the process employed; thus the Bessemer process yields something less than 1 ton of steel, while the open-hearth process or the electric-steel-furnace, using a mixture of pig-iron and steel scrap, may produce more than 2 tons of steel per ton of pig-iron. Without attempting to analyse the steel market in any detail, it seems probable that some 25 or 30 tons daily of pig-iron could be converted into steel and disposed of in the form of small steel rods and rolled sections, steel castings, and other steel products.

The price of pig-iron in British Columbia will, in general, depend on the price in the Eastern States, together with the freight and the import duty. The following table, supplied to me by Mr. W. G. Dauncey, shows the cost of pig-iron during the last ten years per long ton of 2,240 lb.—

Cost of Pig-iron during Recent Years.

Year.	No. 1 Foundry, Philadelphia.	Bessemer, Pittsburgh.	Foundry, Cincinnati.	Foundry, Chicago.	Low Sulphur, Chicago.
1908	$17 33	$17 03	$15 83	$17 25	$20 25
1909	17 30	17 46	16 05	17 48	19 50
1910	16 87	17 16	14 85	17 10	18 69
1911	15 20	15 74	13 62	15 19	17 00
1912	15 98	15 04	14 96	15 77	16 75
1913	16 56	17 16	14 98	16 39	16 55
1914	14 59	14 90	13 41	14 15	15 61
1915	15 25	15 85	13 49	14 46	16 31
1916	21 20	24 00	18 74	20 67	21 00
1917	40 68	43 62	38 01	41 06	44 25

During 1917 the prices became very erratic and shot up to enormous figures. The United States Government consequently regulated the price of pig-iron and that of the ore and fuel needed for its production. From September, 1917, to September, 1918, a standard price of $33 was fixed for pig-iron at Birmingham; other varieties of iron ruling at somewhat higher figures. Thus No. 2, Philadelphia, has been sold at $34.40; Bessemer, Pittsburgh, at $36.60; and Lake Superior (charcoal), Chicago, at $37.85. In October, 1918, these prices have been raised in most cases about $1.

Before the war, with Eastern prices about $15 per long ton, the price in British Columbia would be between $25 and $30. Mr. Nichol Thompson states that during his thirty years' experience he has only once seen pig-iron under $22 per ton, and that the price has ranged from $22.50 to $32.50 per short ton; that is, $25.20 to $36.40 per long ton. It is frequently mentioned that Chinese pig-iron has been imported at a price of $19.50. This iron was brought in as ballast, it was ungraded, and I understand that it was of very poor quality and that some of the buyers have been unable to use it. It is possible, also, though I cannot now check this point, that the price was for a short ton, corresponding to $21.84 per long ton. The only importation from China since 1913 was in the year 1916-17, amounting to 400 tons; and in view of the requirements of Japan, it seems unlikely that any Chinese iron will come to British Columbia in the near future.

The present price for pig-iron in the Eastern States is $33 per ton; adding to that a freight of $15 and a duty of $5 would make $53 in British Columbia. As, however, the exportation of iron from the United States has been prohibited, the actual price is higher than this, and has ranged from about $60 to $80 per long ton.

While it is impossible to predict the course of prices after the war, it seems likely, in view of the high cost of living and the increasing powers of the working-classes, that the price of labour, and consequently the price of manufactured products, will not return again in the near future to the pre-war figures. If we may assume that Eastern prices of pig-iron will not fall below $20, it will follow that the normal price of pig-iron in British Columbia will not fall below $35, or at the lowest price $30, for a period of several years.

The freight from Eastern iron centres to Vancouver has been about $10 per ton, but is higher at present. In August the rate from Hamilton to Vancouver on iron and steel was 60 cents per 100 lb., or $13.44 per long ton. Freight rates from American furnaces cannot be

obtained at present, as the export of pig-iron is prohibited. The duty on pig-iron from the States is $2.80 per long ton plus 7½ per cent. *ad valorem*, which at present prices comes to about $2.25 per long ton, or a total charge of about $5 per long ton.

The B. L. Thane Corporation place the price of pig-iron in California as $25 per ton before the war, being the Eastern price of $15 plus $10 freight. At present they take the Government price of $33 at Birmingham plus $10 freight, or $43 a ton. They assume that after the war the price will be about $28 per ton, or an advance of $3 over pre-war prices. They consider that the market for iron and steel on the Coast is at least 600,000 or 700,000 tons a year, and probably 1,000,000 tons.

British Columbia is very well situated for shipping manufactured products to Japan and the East generally, and if pig-iron and steel could be produced cheaply we might be able to command a considerable export market. Electric-furnace iron will, however, be too costly to compete with blast-furnace iron, even when the latter is brought long distances by water. Wherever there is an iron industry there will be a moderate demand for high-grade pig-iron, and an electric-smelting industry in British Columbia will probably be able to develop a fall market for this product throughout the East.

Mr. Dauncey's table of iron prices shows that in normal times there is a difference of $3 or $4 between the price of different classes of pig-iron. In August, 1913, the prices of Bessemer and foundry irons varied from $50 to $55, including freight, at most points in Eastern Canada, and electric-furnace pig-iron was sold at Eastern Canadian furnaces at a standard price of $58.

With regard to the possibility that a blast-furnace plant may be established in the State of Washington, and that it may capture the market for iron in British Columbia, I may state that the B. L. Thane Company estimate the cost, under 1918 conditions, of making iron in the State of Washington at $22, $26, and $30, on three assumptions with regard to the cost of supplies. Taking the middle estimate, $26, and adding the freight, say $2, and the Canadian duty of $4.75, would raise the cost of iron delivered in British Columbia to about $33; a figure which is about the same as the cost of making electric-furnace iron with power at $15. The bounty offered by the British Columbia Government would, apparently, turn the scale in the favour of the electric product. After the war the war duty of 7½ per cent. *ad valorem* will no doubt be withdrawn, and in general we must expect that a blast-furnace plant on the Pacific coast would be able to take a part at least of the market in British Columbia for the cheaper grades of iron, but, with the help of the Canadian duty and the Provincial bounty, an electric-smelting plant in British Columbia should be able to retain the local market for the higher grades of iron.

Information with regard to the price of pig-iron in British Columbia differs considerably: Mr. Watson Griffin, Superintendent of the Commercial Intelligence Branch of the Department of Trade and Commerce, Ottawa, on September 4th quotes "one of the largest ship-building companies on the Pacific coast" as saying: "We beg to advise that we have been paying for pig-iron during the last year between $65 and $75 per ton of 2,000 lb." This would be between $73 and $84 per long ton. On October 19th he quotes the Industrial Commissioner of Vancouver as saying: "The prevailing prices during the past two years have been from $45 to $69 per ton, which is the price at the present time for Hamilton pig-iron delivered at Vancouver. The present quantities required in British Columbia will run approximately from 7,000 to 10,000 tons per year. I have been unable to get an estimate of the quantities that will be required in the next two or three years." Mr. Griffin subsequently ascertained for me that these lower prices referred to the long ton.

APPENDIX II.*

SUPPLIES OF IRON ORE.

There are, in easily accessible parts of British Columbia, a number of deposits of magnetite ore that appear to be suitable for electric smelting. In the absence of a regular demand for such ores, scarcely any of these deposits have been opened up, and it is impossible to state with any degree of accuracy the amount and analysis of the ore or the cost of mining it.

In view of these circumstances, it was arranged that Mr. Wm. Fleet Robertson and Mr. Brewer would furnish me with the best information at their disposal with respect to the ore-bodies, and that I would use this information as the basis of my report; it being understood that I am not accepting any responsibility with regard to the accuracy of such information. I have, however, been able to obtain some independent data, which agree in general with those furnished by the Government officials.

Amount of Ore needed.—As the ore may be assumed to contain, on an average, not much more than 50 per cent. of iron, about 2 tons of ore will be needed for each ton of pig-iron. Thus for a production of 50 tons of pig-iron daily we must have 100 tons of ore, or 35,000 tons per annum. A supply of 50,000 tons per annum for ten years, or 500,000 tons in all, would appear adequate for the present inquiry.

Location of Deposits.—It is assumed, for the purpose of this report, that an electric-smelting plant would be erected at some point on tide-water within a reasonable distance of Vancouver; its location being determined, among other considerations, by the need of obtaining electric power from the lines of an electric power company. It follows from this that the ore-deposits selected for consideration should be those that are situated on tide-water within easy transportation distance by water from Vancouver.

Available Ore-deposits.—A statement compiled by Mr. Wm. Brewer, and approved by Mr. Wm. Fleet Robertson, will be found in this Appendix. It contains a list of the more important deposits of iron ore that are likely to prove suitable for supplying an electric smelter. The statement shows the distance of each deposit from tide-water, the estimated amount of ore, and the percentage of iron, sulphur, phosphorus, and insoluble in samples taken from each deposit. It appears from the statement that there are several conveniently situated deposits, any one of which may be expected to furnish the required amount of ore. There can be little doubt that if two or three of these were opened up a sufficient supply of ore of reasonable richness and purity would be obtained.

Nature of the Ores.—The ores available are almost all magnetites. Such ores are less easily smelted in blast-furnaces than hæmatite ores, and it is usual, therefore, to provide for an admixture of hæmatite when smelting magnetites. It is quite likely that, in electric furnaces, hæmatite ores would smelt more readily than magnetites, although, as very little preliminary reduction of the ore can be effected in such furnaces, the difference is likely to be less marked. It happens, however, that the commercial smelting of iron ores in electric furnaces has nearly always been carried out with magnetites, either alone or with small additions of hæmatites, so that we know definitely that magnetite ores are suitable for electric smelting.

The ores available, while adequate in amount and convenient in location, are neither as rich in iron nor as free from impurities as the magnetite ores that have been smelted in electric furnaces in Sweden or California. Many of the Swedish ores contain as much as 60 per cent. of iron, and the Californian ore has nearly 70 per cent. of iron, but the ores available in British Columbia cannot be assumed to average more than 50 or 55 per cent. The published analyses of ore samples, including those contained in this Appendix, frequently show as much as 60 per cent. of iron, but Mr. Fleet Robertson is satisfied that, if the ore-bodies are mined in a wholesale way, and without any attempt to pick the best ore, it will not be safe to count on an average richness of more than 50 to 55 per cent. of iron. He informs me, however, that the gangue accompanying the ore is limey in character, and that by taking a suitable proportion of the rock with the ore, a smelting mixture can be obtained having enough limestone to be self-fluxing, and carrying at least 50 per cent. of iron. It may be pointed out that for making a foundry iron

* A map to illustrate this Appendix and the enclosed report by Mr. Brewer has been prepared by Mr. W. F. Robertson, and should be bound with this report in the event of it being printed.

some silica is essential in the smelting mixture; thus, at Heroult, the ore was so pure that it was necessary to add quartz. Moreover, a certain amount of slag must be produced to flux off the sulphur which is present in the ore. Greater economy would undoubtedly result, however, if the smelting mixture could be made to contain as much as 60 per cent. of iron.

The Swedish ores are exceptionally pure, containing usually from 0.01 to 0.02 per cent. each of phosphorus and sulphur, and the ore at Heroult, in California, containing only 0.01 per cent. each of phosphorus and sulphur. The available ores in British Columbia are reasonably free from phosphorus, containing as a rule less than 0.03 per cent. of this element, so that Bessemer iron can be made from them. The sulphur is, however, somewhat higher than is desirable. Some of the ores, notably those from Texada island, contain some tenths of a per cent. up to 1 per cent. of sulphur, but it seems probable that a supply could be obtained that would not contain more than about 0.1 per cent. of that element. This amount of sulphur will not interfere at all seriously in the production of a good foundry iron, but it will render the ore less valuable for making special grades of "charcoal" iron.

From among the various deposits three groups have been selected—namely, those on Texada island, Nos. 1, 2, and 3; those on Redonda island, Nos. 9 and 10; and those at Nootka sound, Nos. 13 and 14. Mr. Brewer has prepared estimates of the cost of mining the ore from each of these deposits and transporting it to a port on the east coast of Vancouver island, or in the neighbourhood of Vancouver. He finds that, including a royalty of 50 cents per ton to the owner and miner of the ore, the cost of ore delivered at the smelter will be about $4 per net ton. As about 2 net tons of ore will be needed for each long ton of pig-iron, the cost of the ore will be about $8 per ton of pig. This is a very serious item of cost, and is far higher than the usual cost of ore at Eastern furnaces. In view, however, of the nature of the ore-bodies, the moderate scale of mining and transportation, and the high cost of all operations on the Coast, it does not appear that any material reduction can be expected, at any rate during the next few years. If the ore were being mined for sale, there should be added the Provincial Government tax of 37½ cents per ton; but in the present case it appears reasonable to count this as a deduction from the bonus of $3 per ton paid by the Government for pig-iron produced locally from British Columbia ores.

IRON ORES OF BRITISH COLUMBIA.

(Data compiled by Wm. M. Brewer, Resident Engineer, Western Mineral Survey District, Nanaimo, B.C., June 8th, 1918.)

The accompanying tables show:—

First: The estimated cost for mining and transporting iron ore mined from the most accessible properties to any established port on the east coast of Vancouver island or at Vancouver.

Second: The names and locations of the various properties, with the distance from deep water, also the available tonnage, very roughly estimated, in three classifications—"actual," "probable," and "possible" ore. Owing to the lack of development-work it is impossible to measure the ore reserves with any degree of accuracy. Where a star is placed beside the name of a property it indicates that it is impossible to make any estimate of available tonnage at present.

Third: The nature of the ore and assay results obtained from the samples collected at various times, together with the names of the collectors.

Estimated Cost of Mining and Transporting Iron Ores.

Three deposits only have been considered in the following table, viz.: Those located on Texada and Redonda islands and at Nootka sound. These are selected because, owing to their accessibility, together with the quantity and quality of the ore, they would be the natural choice as the first sources of supply.

Texada Island, Nos. 1, 2, 3—

Estimated cost of 3-drill plant	$ 5,000
Estimated cost of transportation	10,000
Estimated cost of bunkers and docks	10,000
Total estimated cost of installation	$25,000

Estimated Cost of Mining and Transportation per Ton of 2,000 Lb.
(Figuring 50,000 Tons per Annum).

Interest and depreciation on installation at 20 per cent	$0 10
Estimated cost of mining	2 00
Estimated cost of tramming	25
Estimated cost of freight	1 00
Estimated cost of unloading	25
	$3 60
Royalty to owner per ton	50
Cost of ore at smelting plant	$4 10

Redonda Island, Nos. 9 and 10—

Estimated cost of 3-drill plant	$ 5,000
Estimated cost of bunkers and docks	10,000
No transportation required.	
Total estimated cost of installation	$15,000

Estimated Cost of Mining and Transportation per Ton of 2,000 Lb.
(Figuring 50,000 Tons per Annum).

Interest and depreciation on installation at 20 per cent	$0 06
Estimated cost of mining	2 00
Estimated cost of loading	15
Estimated cost of freight	1 00
Estimated cost of unloading	25
	$3 46
Royalty to owner per ton	50
Cost of ore at smelting plant	$3 96

Nootka Sound, Nos. 13 and 14—

Estimated cost of 3-drill plant	$ 5,000
Estimated cost of tram-line	10,000
Estimated cost of bunkers and docks	10,000
Total	$25,000

Estimated Cost of Mining and Transportation per Ton of 2,000 Lb.
(Figuring 50,000 Tons per Annum).

Interest and depreciation on installation at 20 per cent	$0 10
Estimated cost of mining by large quarry	1 50
Estimated cost of tramming	25
Estimated cost of freight	1 50
Estimated cost of unloading	25
	$3 60
Royalty to owner per ton	50
Total	$4 10

NOTE.—The estimated cost for freight is based on transportation by scows or barges from the Texada Island and Redonda Island deposits, and by freight-steamers properly equipped for hauling iron ore from the Nootka Sound deposits in cargoes of 500 tons and upwards.

(After consultation with Mr. R. H. Stewart, Mr. Brewer has decided to increase his estimate for a 3-drill plant to $12,000 in view of present conditions. This change will only represent a few cents per ton added to the estimated cost of mining.)

Names and Locations of Properties.

No.	Name of Property.	Location.	Approximate Distance from Deep Water.
1	Prescott	Texada island	1,000 feet.
2	Paxton	Texada island	About one mile.
3	Lake	Texada island	About 1½ miles.
4	Iron River*	Branch of Quinsam river, east coast of V.I.	13 miles.
5	Quinsam Lake Iron Syndicate	Upper Quinsam lake, near east coast of V.I.	About 25 miles.
6	Iron Crown*	Nimpkish (Klaanch) river, near Nimpkish lake, V.I.	About 21 miles.
7	Kitchener*	Wigwam bay, Seymour inlet, Queen Charlotte sound	Close.
8	Alexander*	South shore of Seymour inlet, Queen Charlotte sound	Close.
9	Elsie*	West Redonda island	On shore.
10	Black Warrior*	West Redonda island	On shore.
11	Cumshewa*	Louise island of Queen Charlotte group	On shore.
12	Eagle and Sunrise	West arm of Quatsino sound, V.I.	
13	Glengarry and Stormont	Head bay, Nootka sound, west coast of V.I.	1¼ miles.
14	Fido	Head bay, Nootka sound, west coast of V.I.	1½ miles.
15	Western Steel*	Sechart, Barkley sound, west coast of V.I.	2 miles.
16	Bald Eagle*	Sechart, Barkley sound, west coast of V.I.	2 miles.
17	Crown Prince	Sechart, Barkley sound, west coast of V.I.	2 miles.
18	Sarita	Sarita river, Barkley sound, west coast of V.I.	1½ miles.
19	Clifton	Tzartoos island, Barkley sound, west coast of V.I.	½ mile.
20	Black Prince	Uchucklesit harbour, west coast of V.I.	½ mile.
21	Henderson Lake	Henderson lake, west coast of V.I.	1,000 feet to lake, 12 miles to deep-sea harb'r.
22	Defiance*	Handy creek, Alberni canal, V.I.	1 mile.
23	Rose*	Gordon river, near Port Renfrew, V.I.	5 miles.
24	Sirdar	Gordon river, near Port Renfrew, V.I.	9 miles.
25	Conqueror	Bugaboo creek, tributary of Gordon river, near Port Renfrew, west coast of V.I.	9 miles.
26	Baden Powell and Little Bobs	Gordon valley, west coast of V.I.	7 miles.
27	Prince's Iron*	West arm, Quatsino sound, west coast of V.I.	2 miles.
28	Britton and Monarch	Chromium creek, tributary of Klinaklina river, flowing into Knight inlet, mainland coast	
29	North Pacific Iron Mines	Limonite (Summit) creek, tributary of Zymoetz river, Skeena Mining Division	60 miles from G.T.P. Rly.
30	Glen Iron Mine	Cherry bluff, Kamloops lake, 13 miles west of Kamloops	Adjoins C.P.R. track.
31	Ralph*	East Sooke, V.I.	1 mile.
32	Darby and Joan*	Alberni canal	½ mile.
33	Iron Mountain and Chieftain	Kennedy lake, V.I.	18 miles.

Quantity Roughly Estimated.

No.	Actual Ore.	Probable Ore.	Possible Ore.	Total Ore.	Remarks.
	Tons.	Tons.	Tons.	Tons.	
1	...	1,366,400	993,600	2,360,000	McConnell's estimate.
2	...	1,607,200	...	1,607,200	McConnell's estimate.
3	...	504,000	...	504,000	McConnell's estimate.
5	...	...	5,000,000	5,000,000	Brewer's estimate.
7	...	...	...	...	(*See* report by George Clothier,
8	...	...	...	...	M.E., Minister of Mines' Report, 1917, p. 64.)
13	250,000	250,000	750,000	1,250,000	Brewer's estimate.

Quantity Roughly Estimated—Concluded.

No.	Actual Ore.	Probable Ore.	Possible Ore.	Total Ore.	Remarks.
	Tons.	Tons.	Tons.	Tons.	
14	...	50,000	200,000	250,000	Brewer's estimate.
17	75,000	...	200,000	275,000	Brewer's estimate.
18	...	30,000	25,000	55,000	Provincial Mineralogist's estimate.
19	3,000	5,000	25,000	33,000	Brewer's estimate.
20	15,000	...	15,000	30,000	Brewer's estimate.
21	20,000	...	280,000	300,000	Brewer's estimate.
24	94,000	...	47,000	141,000	Brewer's estimate.
25	16,000	230,000	120,000	366,000	Brewer's estimate.
26	...	500,000	250,000	750,000	Brewer's estimate.
29	...	562,500	1,135,000	1,697,500	McKenzie's estimate. (*See* Lindeman's report in Vol. I., p. 30, "Iron Ore Occurrences in Canada," Can. Dept. of Mines, 1917.)
Totals ..	473,000	5,105,100	9,040,800	14,618,700	

Nature of Ore and Assay Results.

No.	Nature.	Iron.	Sulphur.	Phosphorus.	Insoluble.	Remarks.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	
1	Magnetite "lime gangue"	66.0	*Nil*	Trace	3.3	Average across face of adit 430 feet below the highest outcrop. Brewer's sample.
		68.2	Trace	....	....	Copper, *nil;* manganese, 0.08%; McConnell's sample.
		64.3	0.303	....	....	Copper, 0.14; McConnell's sample.
		55.2	0.266	....	....	Copper, 0.14; McConnell's sample.
		62.57	0.403	0.024	6.46	Lindeman's sampling.
		58.76	0.113	0.011	12.0	Lindeman's sampling.
		63.27	0.347	0.013	4.37	Copper, 0.08%; Lindeman's sampling.
		69.85	0.6	Trace	2.75	Geol. Survey of Canada, 1886, p. 37B.
		67.91	....	Trace	2.96	Fulmer, Geol. Survey of Washington.
		65.71	....	0.013	....	Tenth Census, U.S. Represented lot of 600 tons smelted at Irondale by Puget Sound Iron Co.
2	Magnetite "lime gangue"	59.4	1.07	....	....	Copper, 0.3%; McConnell's sample.
		64.48	1.866	0.005	4.47	Copper, 0.22%; magnesia, 1.13%; lime, 1.32%; alumina, 0.66%; Lindeman's sample.
3	Magnetite "lime gangue"	58.0	1.6	Trace	0.5	Brewer's grab sample from dump.
		57.5	0.046	....	....	Copper, trace; McConnell's sample.
		69.4	0.01	....	....	
		59.57	0.137	0.057	8.33	Copper, 0.08%; alumina, 1.17%; lime, 3.82%; magnesia, 1.05%; Lindeman's sample.
4	Magnetite	56.45	0.53	0.03	7.0	Copper, 0.7%; alumina, 2.07%; lime, 3.77%; magnesia, 1.25%; Lindeman's sample. Property owned by Canadian Collieries (Dunsmuir), Ltd.
		59.77	0.533	0.024	11.0	Lindeman's sample.

Nature of Ore and Assay Results—Continued.

No.	Nature.	Iron.	Sulphur.	Phosphorus.	Insoluble.	Remarks.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	
5	Magnetite, lime, and garnetite gangue	58.6	Trace	Trace	9.3	Brewer's sample from dump.
6	Magnetite	64.23	0.233	0.010	4.12	Lindeman's sample.
		63.89	0.017	0.021	5.30	Copper, trace; alumina, 1.74%; lime, 0.80%; magnesia, 1.86%; Lindeman's sample.
7	Magnetite	65.5	0.5	....	4.6	Clothier's sample, Minister of Mines' Report, 1917.
8	Magnetite	60.0	0.30	0.11	6.37	Alumina, 7.6%; lime, 1.8%; combined water, 0.11%; magnesia, trace; Clothier's sample.
9	Magnetite	71.28	....	....	0.89	Lindeman, Vol. II., "Iron Ore Occurrences in Canada," Can. Dept. of Mines, 1917.
10	Magnetite	....	....	....	....	No samples reported.
11	Magnetite	68.0	0.01	0.008	1.2	Lime, 1.0%; Minister of Mines' Report, 1911, p. 77, and Lindeman's in "Iron Ore Occurrences in Canada," Can. Dept. of Mines, 1917, p. 18.
12	Bog	54.46	0.15	0.038	2.32	Lindeman's sampling.
		56.97	0.447	0.038	1.40	Lindeman's sampling.
13	Magnetite limestone gangue	56.08	0.1	Trace	1.6	Brewer's sample.
		66.17	0.017	0.016	6.1	Lindeman's sample.
14	Magnetite	....	....	....	....	No samples reported.
15	Magnetite limestone gangue	59.69	0.04	0.016	12.76	Lindeman's sample.
16	Magnetite limestone gangue	59.37	0.716	0.006	13.36	Lindeman's sample.
		60.7	Trace	Trace	13.6	Brewer's sample.
17	Magnetite limestone gangue	54.4	1.4	*Nil*	21.2	Brewer's sample.
		55.6	0.4	Trace	17.6	Brewer's sample.
		48.4	0.7	Trace	....	Carmichael's sample.
		48.06	0.623	0.006	23.22	Lindeman's sample.
18	Magnetite limestone gangue	63.8	0.55	Trace	4.2	Brewer's sample.
		63.7	0.3	Trace	3.85	Carmichael's sample.
		60.89	0.76	0.004	3.81	Lindeman's sample.
19	Magnetite	56.2	1.3	*Nil*	17.0	Brewer's sample.
		50.4	0.3	0.053	18.6	Carmichael's sample.
		52.09	0.23	0.025	16.52	Lindeman's sample.
20	Magnetite	70.2	Trace	Trace	1.4	Brewer's sample.
21	Magnetite	50.0	0.24	*Nil*	22.0	Carmichael's sample.
22	Magnetite limestone gangue	52.6	4.2	*Nil*	12.1	Gold, trace; silver, 1.2 oz.; copper, 3.3%; Brewer's sample.
		66.0	Trace	*Nil*	3.3	Brewer's sample.
		65.8	2.2	Trace	4.8	Brewer's sample.
23	Magnetite	61.9	0.34	....	....	Hand sample reported by Carmichael.
24	Magnetite	56.57	2.75	0.121	8.52	Lindeman's sample.
25	Magnetite	67.09	1.6	0.009	4.51	Lindeman's sample.
26	Magnetite	58.3	2.75	0.013	8.88	Lindeman's sample.
27	Bog	54.46	0.15	0.038	2.32	Lindeman's sample.
		56.97	0.447	0.038	1.40	Lindeman's sample.
		52.0	....	0.5	....	Carmichael's sample.
28	Hæmatite	47.6	*Nil*	Trace	....	Galloway's sample.
		48.4	*Nil*	Trace	....	Galloway's sample.
		57.0	Trace	Trace	....	Galloway's sample (selected).

Nature of Ore and Assay Results—Concluded.

No.	Nature.	Iron.	Sulphur.	Phosphorus.	Insoluble.	Remarks.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	
						First four samples by McKenzie.
29	Limonite	54.20	1.16	0.407	1.02	Manganese, 0.85; water combined, 18.54.
		56.01	1.52	0.016	0.83	Manganese, 0.51; water combined, 16.02.
		54.32	1.14	0.065	1.99	Manganese, 0.39; water combined, 20.47.
		52.19	1.47	0.616	1.56	Manganese, 0.70; water combined, 19.61.
		51.0	1.7	*Nil*	2.0	Brewer's sample.
		50.6	0.8	*Nil*	1.7	Owner's sample.
		53.2	2.65	0.0016	1.31	Owner's sample.
		53.2	1.89	0.014	1.62	Owner's sample.
		54.0	1.15	0.002	1.04	Owner's sample.
30	Magnetite	64.81	0.158	Trace	4.21	McEvoy's samples. (*See* "Iron Ore Occurrences in Canada," Can. Dept. of Mines, 1917, p. 31.)
		62.03	0.170	Trace	3.85	
		63.24	0.17	Trace	4.05	
31	Magnetite	....	....	....	....	Ore carries too much copper to be suitable for iron-making.
32	Magnetite	50.96	0.083	0.004	25.96	Lindeman's sample.
		55.9	1.0	....	16.0	Carmichael's sample.
33	Magnetite	30.1	0.31	Trace	51.5	Brewer's sample.
		63.07	0.043	0.016	7.64	Lindeman's sample.

(End of Mr. Brewer's report.)

IRON ORE FROM HEAD BAY.

In view of the importance of obtaining more exact information in regard to the richness and other characteristics of the available ore, I discussed with Mr. W. F. Robertson the possibility of having a quantity of ore taken from one or more of the deposits, and sending large samples to Victoria for analysis and for tests in regard to magnetic concentration. Mr. Robertson considered that it was not necessary to undertake this at the present time, but he instructed Mr. Brewer to obtain a large general sample of ore from the deposits at Nootka sound, Head bay. In a letter from Mr. Robertson dated August 12th, 1918, and enclosing an assay certificate dated August 9th, he informs me that Mr. Brewer took nine samples from various parts of the deposit, including two near the margin. He also took a sample of the foot-wall. The nine samples were assayed separately for iron and were found to contain: 63 per cent., 70 per cent., 67.2 per cent., 63 per cent., 63 per cent., 44.8 per cent., 47.8 per cent., 67.2 per cent., and 68.2 per cent. The samples containing 44.8 and 47.8 per cent. were taken near the margin of the deposit. A composite sample was made up containing equal amounts of each of the above nine samples and of the one foot-wall sample. This composite sample was analysed and was found to contain:—

	Per Cent.		Per Cent.
Iron	57.1	Sulphur	Trace.
Silica	15.5	Phosphorus	0.05
Lime	0.6		

The average richness of the ore itself is 66 per cent. of iron, and the average richness, including the two samples near the margin, is 61.6 per cent. The composite sample contained 57.1 per cent. of iron, from which it can be calculated that the wall-rock would contain 16.8 per cent. of iron. If we assume that the samples are representative of the deposit, we learn that the rich ore contains 66 per cent. of iron, and that a general sample, including ore near the margin and some of the wall-rock, contains 57 per cent. of iron. We may apparently conclude from this that in general mining an ore of at least 55 per cent. of iron can be expected. It appears, further, that the gangue-matter is siliceous and contains very little lime, and that the ore is free from sulphur and below the Bessemer limit in phosphorus.

The Head Bay deposits appear as Nos. 13 and 14 in Mr. Brewer's list, but Mr. Brewer does not state from which of these properties his present samples were taken, or whether the samples were taken from both properties. The weight of the samples is also not mentioned. Mr. Robertson considers that the above results are higher than would be obtained from an average shipment of ore from this deposit.

NOTES FROM THE B. L. THANE COMPANY.

The following notes on four deposits of iron ore in British Columbia were given me by the B. L. Thane Company, of San Francisco, and are of value as supporting the conclusion that there is available an adequate supply of magnetite ore. The analyses quoted indicate a higher grade of ore than that on which I have based this report.

Texada Island.—Deposit of magnetite owned by the Puget Sound Iron Company. The deposit contains 1,000,000 tons and probably an additional 2,900,000 tons. The ore is loaded into ships near the mine. The ore contains:—

	Per Cent.		Per Cent.
Iron	62.9	Magnesia	0.75
Silica	6.66	Nickel	0.014
Phosphorus	0.016	Cobalt	0.005
Sulphur	0.51	Copper	0.13
Alumina	1.4	Titanium	*Nil.*
Lime	2.0	Arsenic	*Nil.*

The estimated cost (pre-war) at a Puget Sound port was:—

Mining	$0 56
Land transportation	10
Sea transportation	50
Royalty	25
Fixed charges	20
Export duty	50
Total	$2 11

Or $3.18 per ton of pig-iron.

The assumed output was 200,000 tons a year for twenty years. A tram from the mine of 1.1 miles would cost $10,000; equipment and development of mine, $290,000; total, $300,000.

Cumshewa.—A deposit of magnetite on Louise island, owned by H. K. Owens, contains 570,000 tons, with a probable 344,000 tons more. The ore is loaded into ships near the mine. The ore contains:—

	Per Cent.		Per Cent.
Iron	60.0	Sulphur	0.020
Silica	7.0	Lime	2.0
Manganese	0.83	Titanium	0.07
Phosphorus	0.008		

Pre-war cost:—

Mining	$0 75
Land transportation	15
Sea transportation	75
Fixed charges	71
Export duty	50
Total	$2 86

Or $4.86 per ton of pig-iron.

Assumed output, 100,000 tons per annum for nine years. An aerial tram of 1.5 miles from mine to wharf would cost $20,000; purchase of mine, $200,000; equipment and development, $100,000; total, $320,000.

Head Bay.—A deposit of magnetite on Vancouver island, owned by Glengarry, Canadian Collieries (Dunsmuir), Limited, and Clarence Dawley, Clayoquot, contains 150,000 tons, with a probable 250,000 tons more. Ship from Nootka sound. It contains:—

	Per Cent.		Per Cent.
Iron	60.0	Phosphorus	0.008
Silica	8.0	Sulphur	0.013

Pre-war cost:—

Mining	$0 90
Land transportation	10
Sea transportation	65
Royalty	25
Fixed charges	30
Export duty	50
Total	$2 70

Or $4.27 per ton of pig-iron.

Assumed output, 60,000 tons per annum for seven years. Would need an aerial tram of 1.5 miles from mine to wharf, costing $20,000; development and equipment, $50,000; total, $70,000.

Quinsam Lake.—A deposit of magnetite owned by Jones & Thomson, probably contains 500,000 tons. Ship from Campbell river. It contains:—

	Per Cent.		Per Cent.
Iron	60.0	Lime	1.7
Silica	4.0	Phosphorus	0.002-0.976
Manganese	0.65	Sulphur	0.005-0.068
Alumina	2.6		

Pre-war cost:—

Mining	$0 90
Land transportation	60
Sea transportation	50
Royalty	25
Fixed charges	2 12
Export duty	50
Total	$4 87

Or $7.71 per ton of pig-iron.

Assumed output, 60,000 tons per annum for eight years. Needs a twenty-mile aerial tram, costing $220,000; development, $60,000; total, $280,000.

With regard to the estimated cost of mining and transporting these ores, we find (excepting the last in view of the unusually heavy fixed charges) the total costs to be $2.11, $2.86, and $2.70 per ton of ore. Deducting the export duty of 50 cents, these become $1.61, $2.36, and $2.20 per ton. Messrs. B. L. Thane consider that the 1918 costs for labour, materials, transportation, and capital charges would all be doubled, thus leaving a duty-free cost of $2.97, $4.22, and $4.15 per ton, or an average cost of $3.78 per ton. Remembering that these relate to outputs of 200,000 tons, 100,000 tons, and 60,000 tons respectively, it does not appear that Mr. Brewer's estimate of $4 a ton on an output of 50,000 tons is at all too high.

NOTES ON COST OF MINING AND TRANSPORTATION.

I. Mr. W. M. Brewer in a letter dated July 8th, 1918, writes me that he has had interviews with Mr. R. H. Stewart in regard to the cost of mining and with Captain Simon MacKenzie in regard to the cost of transportation.

Mr. Stewart stated that where the iron ore would be mined by quarrying and there would not be very much development-work and only a reasonable amount of sorting, the cost of mining iron ore at the deposits on Texada island, Redonda island, and Nootka sound (Head bay) should not exceed $1 per ton, even when a quantity of only 100 tons a day was being mined. He also said that Mr. Brewer's estimate of $5,000 for the cost of installing a 3-drill compressor plant at any of these mines should be increased to about $12,000 in view of present conditions.

Captain MacKenzie stated that Mr. Brewer's estimate of $1 per ton for transporting iron ore from Texada island or Redonda island to the neighbourhood of Vancouver was reasonable, provided that good dispatch were given in loading and discharging, and that a regular business could be ensured averaging not less than 700 tons a week. He also stated that if the ore was only to be hauled a short distance, as, for example, from the west coast of Texada island or Redonda island to the east coast of Vancouver island, say in the neighbourhood of Union bay, the charge for transportation should not exceed 50 cents or at the outside 75 cents per ton, provided that regular business, handling 700 tons a week, were established with reasonable dispatch, say ten hours for loading and twenty-four hours for discharging cargo. Captain MacKenzie considered that Mr. Brewer's estimate of $1.50 per ton for transporting iron ore from Nootka sound to the neighbourhood of Vancouver would be all right under reasonably normal conditions, although at the time of writing the transportation companies were asking about $3 per ton in cargoes of 700 tons.

II. I have received from Mr. Robertson, under date of July 6th, 1918, the following memorandum *re* transportation of ore, etc., from Mr. H. L. Drummond, Manager, North-west Lighterage Company, Seattle.

Iron Ore from West Coast, Vancouver Island—

In lots of 1,000 tons .....Estimated at $1.50 to $2 per ton.
In lots of 2,000 tons .....Estimated at $1.50 per ton.

Iron Ore from Texada Island (on Long Contract)—

In lots of 500 tons ..... 90 cents per ton.
In lots of 800 tons ..... 80 cents per ton.
In lots of 1,000 tons ..... 65 cents per ton.

The Drummond Lighterage Company are transporting:—

Coal from Comox to Seattle at 90 cents per ton.
Coal from Nanaimo to Seattle at 75 cents per ton.

They take 1,200 tons per trip and from 15,000 to 18,000 tons per month. The charge for carrying copper ore from Sidney inlet to Tacoma is from $3.50 to $4 per ton.

Conclusions.—(1.) Raising the estimate for the 3-drill plant from $5,000 to $12,000 will increase the cost of equipping each mine by $7,000, but will only increase the cost per ton of ore by about 3 cents.

(2.) The original transportation estimate of $1 a ton from Texada and Redonda and $1.50 a ton from Nootka sound are supported by the above notes.

(3.) With reference to the cost of mining, Mr. Robertson considers that, in view of the need of obtaining an ore of reasonable richness, the cost of mining would certainly be higher than Mr. Stewart's estimate of $1 per ton, and that $2 is as low as can safely be estimated under present conditions. We may reasonably suppose, however, that in course of time, when the industry becomes better established, and if the ore-deposits are found to be large enough, the cost of mining may possibly come down to about $1 per ton, even with the present rates of wages.

Notes on Various Iron-ore Deposits.

I. *Iron-deposit at Sarita River.*—I received from the Hon. Wm. Sloan a letter dated June 7th from Mr. J. F. Bledsoe, Manager of the Central Iron Committee of Vancouver Island, enclosing a note from Mr. Wm. Lorimer, of 576 Toronto Street, Victoria, B.C., in regard to the iron-ore deposit at Sarita river. Mr. Lorimer, under date of June 6th, states that this deposit has been mined to the extent of forming a dump of ore, and suggests that some of this ore should be sent to the laboratory at Victoria for treatment. He offers to sack and ship as much ore as may be required, and would make no charge for this beyond his expenses. This deposit is No. 18 in Mr. Brewer's list. It is estimated to contain probably 30,000 tons, with a possible 25,000 tons additional. The deposit is one mile and a half from deep water. It would certainly be of interest to have a quantity of this ore supplied for chemical analysis and other tests, but it will be more worth while to open up some of the larger deposits which are situated close to deep water. Moreover, the samples received from this deposit have been rather high in sulphur, as is shown in Mr. Brewer's report.

II. *Kitchener Group, West Redonda Island, and other Deposits.*—Mr. Nichol Thompson, of Vancouver, has placed at my disposal certain information respecting the iron-ore deposits in

British Columbia. This includes a general synopsis of the iron-deposits in British Columbia, and reports with regard to the *Kitchener* group, the *Elsie* claim, on West Redonda island, and other claims, from which I extract the following:—

The *Kitchener* group (No. 7 in Mr. Brewer's list) is located on Wigwam bay, Seymour inlet, Queen Charlotte sound. A report by G. A. Clothier, February, 1918, shows vein No. 2 to contain 65.5 per cent. iron, 4.6 per cent. insoluble, and 0.5 per cent. sulphur; and vein No. 3 to contain 64.4 per cent. iron, 1.8 per cent. insoluble, and 0.1 per cent. sulphur. Further surface work would be needed to prove the continuity of the ore-shoots on the surface before diamond-drilling to prove them at depths would be justified. A sample of the *Kitchener* ore supplied by Mr. Thompson on July 24th, 1916, was found to contain:—

	Per Cent.	
Peroxide of iron	64.35	Iron, 64.5 per cent.
Protoxide of iron	25.16	
Protoxide of manganese	0.47	
Alumina	0.96	
Lime	1.00	
Magnesia	3.89	
Sulphur	Slight trace.	
Phosphorus	Slight trace.	
Insoluble	4.70	
Total	100.53	

A report of the *Elsie* claim, on West Redonda island (No. 9, Mr. Brewer's list), by Alexander Sharp, Vancouver, October, 1917, contains the following summary: "The *Elsie* mineral claim has a well-defined magnetite-iron ore vein, fully 30 feet wide, probably extending from the east to the west boundary, and to depth. The ore is high grade, almost free from sulphur, phosphorus, and other impurities. Situated on tide-water, where the largest ocean-going ship can be loaded at any tide, the mineral can be easily and cheaply mined."

Mr. Sharp quotes the following analyses for this ore:—

	Per Cent.		Per Cent.
Iron	65.0	Iron	61.10
Sulphur	None.	Silica	7.31
Insoluble	9.20	Lime	3.10
		Phosphorus	0.015
		Sulphur	0.30

Some 626 tons of this ore was shipped to the Oswego Iron and Steel Company's furnace in Oregon. The average iron content was 60.8 per cent., and the ore was reported to work well in the puddling-furnace.

Mr. Thompson also supplied me with reports by J. H. Scott, of London, and W. Newman, of Vancouver, with regard to the *Shoo Fly* and *Nellie C.* claims of iron ore situated near Cardero channel, in the Coast District of British Columbia, 120 miles north of Vancouver City. The reports speak very favourably of the amount and nature of the ore, but the analyses they quote show only 50 per cent. of iron and as much as 2 per cent. of sulphur, which does not support their statements with regard to the value of the ore. The complete analysis quoted is:—

	Per Cent.
Ferric oxide	51.80
Ferrous oxide	25.63
Silica	19.50
Sulphur	2.10
Phosphorus	*Nil.*
Titanium	*Nil.*
Water and oxygen	0.97
Total	100.00

Three samples assayed for sulphur showed: 1.75 per cent., 4.5 per cent., and 0.71 per cent. respectively. Eight samples assayed for iron showed: 59.7 per cent., 57.5 per cent., 54.6 per cent., 58.8 per cent., 54 per cent., 59.3 per cent., 51 per cent., and 53.2 per cent. respectively.

APPENDIX III.

MAGNETIC CONCENTRATION OF IRON ORES.

In smelting low-grade ores of iron, it is sometimes economical to dress the ore before smelting it, in order to eliminate most of the barren rock-matter, and thus to reduce the cost of the smelting operation. This preliminary dressing is particularly desirable in the electric smelting of iron ores, on account of the small size of the furnace and the high cost of the smelting operation. Magnetite ores of iron are readily concentrated by means of an electric magnet which picks out the magnetite mineral and leaves the rock. It is necessary, however, to crush the ore sufficiently fine to separate the grains of magnetite from the grains of rock, and the concentrate must therefore be briquetted, or sintered into lumps, to make it fit for the smelting operation.

In the case of an ore containing 50 or 55 per cent. of iron, and costing $4 per ton delivered to the furnace, it would scarcely pay to concentrate, obtaining a product of 65 to 70 per cent. of iron, because the extra cost of the ore (as some is lost in the tailing) and the cost of the operation would about equal the economies to be gained in the smelting. If, however, by mining the ore in a more wholesale manner the cost of mining can be considerably reduced, and if the dressing operation is carried on at the mine or loading-wharf, so that the freight is only charged on the concentrated ore, there is a possibility of obtaining a smelting concentrate at a moderate price.

We may assume, for example, that the ore can be mined to contain 40 per cent. of iron at a cost of $1 per ton, where the 50-per-cent. ore cost $2 to mine. Adding the fixed charge of 10 cents and the royalty of 40 cents (50 cents for a 50-per-cent. ore), the crude ore will cost $1.50 per ton. The crushing to 80 mesh and magnetic concentration may cost 80 cents per ton, making a total of $2.30. Suppose that 2 tons of ore yield 1 ton of a 70-per-cent. concentrate, then the cost will be $4.60 per ton of concentrate. To this we must add a charge of, say, $1 for sintering and $1 for freight, making a total of $6.60 per ton. This corresponds to $9.45 per ton of pig-iron, which is $1.45 more than the cost using raw 50-per-cent. ore at $4 a ton. The saving in the smelting process, due to the use of a richer ore, would be in the order of $3 a ton of iron, thus making a saving of about $1.55 per ton. The items of cost mentioned above have been made higher than usual on account of the increased cost of labour and supplies at the present time.*

Messrs. Beckman and Linden in their report (Appendix XI.) claim a net saving of $3 a ton of iron by dressing a 50-per-cent. ore up to 65 per cent. of iron. They consider the 65-per-cent. ore to cost: 1.3 tons of ore at $4=$5.20, and cost of crushing, dressing, and sintering, $1.25 per ton of concentrate, or a total of $6.45 per ton, or $9.43 per ton of iron. In view of the loss of iron in the tailings, they would probably need about 1.5 tons of ore, costing $6, while the crushing, dressing, and sintering will cost, at present rates, about $2, making a cost of $8 per ton of concentrate, or $12.30 per ton of iron. This is an increase of $4.30 over the cost of using the raw ore, and the saving in the furnace operation will be $2 or $3. Messrs. Beckman and Linden find a gross saving of $4.79, but I believe this is an overestimate. In any case, even allowing for some error in my own estimate, it appears that no material advantage would be gained by dressing a 50-per-cent. ore to obtain one of 65 per cent.

In the Swedish practice a moderate proportion, perhaps 25 per cent. of concentrated ore, "slig," is used unbriquetted in admixture with lump ore, but finely crushed concentrates cannot be used to any great extent in the charge. If the preliminary reduction process (Appendix XII.) is found to be practicable, the ore will have to be crushed, and magnetic dressing will form an essential part of the scheme. The metallized powder can be melted without briquetting, because it will be, largely, a simple melting operation and there will not be a great production of gas in the furnace.

* The foregoing figures refer to a short ton of iron instead of a long ton, but as the discussion is comparative no serious error has thus been introduced.

APPENDIX IV.

ELECTRIC POWER FOR SMELTING.

The possibility of the commercial operation of an electric-smelting plant for the production of pig-iron from iron ore depends on an adequate supply of electric power at a moderate rate. For the electric smelting of iron ores a large amount of power is needed, the amount varying somewhat with the richness of the ore, the grade of iron to be produced, and the kind of furnace employed. Under usual conditions the consumption of electrical power for each long ton of pig-iron lies between one-third and one-half of a horse-power year. For the production of foundry iron from rather low-grade ores, and in a simple pit furnace, it will not be safe to count on the production of more than 2 long tons of iron per annum for each electric horse-power supplied to the works. For a production of 50 tons of pig-iron daily some 8,000 or 9,000 electric horse-power will be needed, and if provision is made for the production of ferro-alloys and the making of steel in electric furnaces, some 10,000 to 15,000 horse-power must be provided.

It was recognized that such a supply could be obtained by developing certain water-powers on Vancouver island or on the mainland, but in view of the need of establishing the smelting industry at the earliest possible date, and of the extreme difficulty and expense of new development-work under present conditions, it was decided, if possible, to use power that was already developed for the initial operation of the plant, and to defer until later the development of fresh power for the permanent operation of the industry.

With this in view a letter was written from the Department of Mines to the general manager of each of the power companies of British Columbia, as follows:—

June 4th, 1918.

DEAR SIR,—Will you kindly furnish me at your very earliest convenience with the following information:—

Whether your company is in a position to supply electrical power, starting, say, at 15,000 electrical horse-power, in the hope of increasing the power within a few years up to 50,000 electrical horse-power.

At what point could you supply it?

The cost for the same, showing how the cost is estimated.

The voltage and frequency of the electric current.

The extent to which a constant supply can be depended on.

I desire to have this information in order to be prepared with the statistics requisite for a thorough investigation into the possibilities of establishing electric iron-furnaces in British Columbia, which will be investigated by Dr. Alfred Stansfield, of Montreal, who is expected to arrive here on the 10th inst.

Yours faithfully.

The following replies were received:—

BRITISH COLUMBIA ELECTRIC RAILWAY CO., LTD.,
HASTINGS AND CARRALL STREETS,
VANCOUVER, B.C., June 10th, 1918.

The Hon. Wm. Sloan,
Minister of Mines,
Parliament Buildings, Victoria, B.C.

DEAR SIR:

Power for Electric Furnaces.

With reference to your letter dated June 5th, enclosing questions regarding the power available from my company's plants for the operation of electric-smelting furnaces, the following data may assist Dr. Alfred Stansfield in his investigation of this subject:—

Our hydro-electric plants are now developed to supply a greater demand for power than exists at the present time, and a portion of this energy might be used for the operation of electric furnaces. You give no information regarding the load factor or power factor at which this energy could be taken, and the amount of power which we could supply necessarily depends on these factors. It is probable, however, that we could furnish 15,000 electrical horse-power with the power-factor and load-factor conditions under which electric furnaces generally operate.

As regards increasing the supply of power from 15,000 horse-power to 50,000 horse-power during the next few years, our Coquitlam-Buntzen power scheme is now fully developed, and it would not be possible to install additional machinery at either of our Lake Buntzen plants. We have, however, in view other water-power schemes on which stream-flow data is now being obtained and which could be developed in the future as the need arises. It might also be possible for us to purchase an

increasing amount of energy if the load conditions on our system warranted such action. My company is therefore in a particularly favourable position to supply the energy which would be required for a large power-load, subject to great expansion.

From the point of view of power-supply, an electric-furnace plant should be located, if possible, in close proximity to the power-house supplying energy for its operation.

Our water-power plants are located on the east shore of the North arm of Burrard inlet, about fourteen miles from the city of Vancouver. The North arm is almost entirely surrounded by high mountains which slope steeply to the water's edge, and there is therefore comparatively little level ground available on which buildings or other structures could be erected. There is, however, a small piece of level ground, triangular in shape, and about ½ acre in extent, at the north end of our No. 1 Power-house, but whether this piece of ground would be sufficiently large I do not know. The advantages of locating the electric-furnace plant adjacent to our power-house may be summarized as follows:—

(1.) Power could be supplied directly from the power-house bus-bars at 2,300 volts, or possibly at a slightly higher voltage. The use of transformers to step up to a voltage suitable for transmission would thus be avoided, and the construction of additional transmission-lines would be unnecessary. If power were taken at any point on our existing transmission-lines, the voltage would be approximately 34,600.

(2.) Two or more of our generating units could be set aside to supply the furnaces, and this load could therefore be entirely independent of our transmission system. In order to make a similar arrangement for any other location of the furnace plant, the construction of a separate transmission-line from the power-house to the furnaces would be necessary. The operation of the furnace plant independently of the remainder of our system would have obvious advantages, both from the standpoint of the consumer and of the power company.

(3.) A substantial concrete wharf equipped with a power-operated derrick is available at No. 1 Power-house. There is sufficient depth of water at this wharf to allow large scows and steamers of fair size to tie up.

(4.) An abundant supply of pure fresh water at a low temperature and at a pressure of approximately 175 lb. per square inch is available at Power-house No. 1.

On account of the location of this plant, the air is clean and contains fewer impurities than would be found in air nearer the city.

If the location at the north end of Power-house No. 1 does not provide sufficient area, another site might be found about half a mile north of No. 1 Power-house. The construction of a plant at that point, however, would involve the building of a short piece of transmission-line over very rough country and the use of transformers, etc.

It is extremely difficult to reply by letter fully and satisfactorily to your questionnaire, but we shall be glad to go into this matter with Dr. Stansfield on his arrival in British Columbia should he desire to investigate the capacity of our plants.

Yours faithfully,
(Signed.) George Kidd,
General Manager.

Western Power Company of Canada, Limited,
Vancouver, B.C., June 13th, 1918.

Hon. Wm. Sloan,
Minister of Mines, Victoria, B.C.

Dear Sir,—I have your communication of June 5th, asking for information in respect to the possibility of a considerable power-supply for electric iron-furnaces, and I must apologize for delay in making answer.

Western Power Company of Canada, Limited, has now in operation in its plant at Stave Falls three 13,000-horse-power units capable of supplying a maximum demand of about 25,000 kilowatts. Of this power the British Columbia Electric Railway Company may demand 15,000 kilowatts, and the balance is nearly all taken up by the company's other customers.

The company has the greater part of the machinery on hand for the installation of the fourth 13,000-horse-power unit, which can be installed when necessary at a comparatively small cost. The turbine for this unit is, however, at the factory in Zurich, Switzerland, where it was built, and there is some question as to when it could be shipped. If this unit were installed, Western Power Company of Canada, Limited, would be in a position to sell 7,000 to 9,000 kilowatts more than at present.

The company has a second site lower down on the Stave river which, if developed in conjunction with the existing plant, could be built very economically, and from this site there could be produced about 40,000 horse-power continuously.

There is nothing in the development of this lower site which would cause the construction to take longer than usual for this class of work.

Power could be delivered from either of these plants at any point between Stave Falls and Vancouver. The most economical point of delivery, so far as power is concerned, would, however, be at Ruskin, which is close to the power-site. In some ways Ruskin would be an advantageous spot for the establishment of an iron-smelter, but if a point on or near Burrard inlet were selected the transmission-line would not be more than twenty-five miles long.

With the above-mentioned developments a very reliable and constant supply of power could be depended upon, for the power plant has a storage-reservoir twenty-four square miles in area and

25 feet deep; besides, the large snow-field and glaciers which feed the Stave river tend to give great regularity in the annual flow, and no trouble of any kind is experienced in operating the plant in winter on account of ice.

The electric current supplied by Western Power Company of Canada, Limited, is of frequency 60 cycles and can be supplied at 60,000 or 12,000 volts. The company has just connected up a 6-ton electric furnace, which has been installed at the works of the Aetna Iron and Steel Company, at Port Moody, and this furnace, which is now producing pig-iron from scrap, is operating very satisfactorily on the 60-cycle current.

For the supply of electric power for smelting iron ores the question of the "cost of power" is more difficult than the question of "quantity of supply." All the plants in the neighbourhood of Vancouver have been designed and built for the supply of general power business, and it is a question whether the electric-smelting furnace could pay a price for the power that would be remunerative to the power companies.

For smelting steel the quantity of power required per ton of product is such that the steel-makers can pay rates which, though low, are remunerative to the power companies. The amount of power required per ton of iron produced from the ore is, however, so much greater than that required for merely melting iron or steel that the price of power for smelting would have to be very low, and it is difficult to see how a price that would have to be secured for smelting would be remunerative to the British Columbia Electric Railway Company or Western Power Company of Canada, Limited.

Western Power Company of Canada, Limited, is selling power to the British Columbia Electric Railway Company at a price which is equal to three mills per kilowatt-hour, and while it would be impossible for the company to sell more power at this low price, it might be possible to do something in co-operation with the British Columbia Electric Railway Company.

It is difficult to present the whole situation in a letter, but the financial organization of Western Power Company of Canada, Limited, is very simple, and its costs are shown very clearly upon its books and monthly statements, so that it would be an easy matter to show Dr. Stansfield exactly how the situation stands. I would very much like to have the opportunity of explaining our costs and possibilities in an interview, either with yourself or with Dr. Stansfield, as my company is interested in doing everything possible to establish the industry of electric smelting, and any information which we have will be at your disposal.

I am, dear Sir,
Yours very truly,

WESTERN POWER COMPANY OF CANADA, LIMITED.
(Signed.) R. F. HAYWARD,
General Manager.

CANADIAN COLLIERIES (DUNSMUIR), LIMITED,
VICTORIA, B.C., June 21st, 1918.

Hon. Wm. Sloan,
Minister of Mines, Victoria, B.C.

DEAR SIR,—Replying to your letter of June 5th *re* information required *re* electric iron-smelting inquiry:

In reply to your question No. 1, we have developed on the Puntledge river about 10,000 horse-power, composed of two units of 5,000 horse-power each. One unit is about working to its capacity, the second being kept in reserve. We would not be able to supply anything like the power you mention without adding further units. The plant is partly developed for another 10,000 horse-power, which would be the total capacity of the plant owing to the volume of water that can be taken out of Comox lake.

I would be glad some time at your convenience to discuss the power situation with you with a view to any iron-development taking over the power plant as a whole and our installing individual steam plants at each mine.

Yours truly,

(Signed.) J. M. SAVAGE,
General Manager.

THE WEST KOOTENAY POWER AND LIGHT CO., LTD.,
ROSSLAND, B.C., June 12th, 1918.

Hon. Wm. Sloan,
Minister of Mines, Victoria, B.C.

DEAR MR. SLOAN,—I beg to acknowledge receipt of yours of the 7th *re* power-supply for electric furnaces.

At present our developed power is all contracted for, and to supply 15,000 horse-power it would be necessary to extend our hydro-electric plant at Bonnington, and for your information would state that we would be able to supply up to 50,000 horse-power.

It will take some time to prepare an estimate as to the cost of developing the power required, and before starting on this I would be very pleased to meet Dr. Alfred Stansfield in order to get further information. In other words, if it so worked out that power could be used at the point of

development, then we would be in a position to quote a lower price than if we were called upon to transmit at any distance, and it appears to me that if you could arrange a meeting it would place me in a very much better position to comply with your request.

Yours very truly,

West Kootenay Power and Light Co., Ltd.

(Signed.) L. C. Campbell,

General Manager.

During my visit to British Columbia I had interviews on this subject with Mr. George Kidd and other officials of the British Columbia Electric Railway Company; with Mr. R. F. Hayward, General Manager of the Western Power Company; and with Mr. J. M. Savage, General Manager of the Canadian Collieries, Limited. In view of the necessity of locating the proposed plant on or near tide-water, it was not worth while to discuss the possibility of obtaining power from the West Kootenay Power Company.

The information obtained verbally from the above-mentioned officials was substantially as follows:—

The Western Power Company have some unused electric power, but this has been contracted to the British Columbia Electric Railway Company. If this contract could be set aside, the former company might be able to supply as much as 15,000 horse-power, at a rate of, say, $15, for a few years until it was needed for better-paying purposes. On the other hand, the British Columbia Electric Railway Company might be willing themselves to resell this block of power for electric smelting. Although the development expenses of these companies have undoubtedly been high, they could apparently make a reasonable profit by the sale of power at $15. As, however, their usual sale price is not less than $25, it would not pay them to tie up power at $15 which they might be able in a year or two to sell at $25. This argument would not hold in normal times, because they could develop some of their reserve power to supply the growing market; but at the present time it is very undesirable to have to undertake any fresh development, and the power companies naturally wish to sell their developed power to the best advantage.

It may be noted that $25 a horse-power year probably refers to an 80-per-cent. load factor, under which conditions the cost is substantially 0.5 cent per kilowatt-hour. Under regular working conditions an electric-smelting plant should use about 90 per cent. of its maximum load, and $25 power would then cost about 0.43 cent per kilowatt-hour, or, conversely, 0.5-cent power would represent nearly $30 a horse-power year.

The British Columbia Electric Railway Company have some unused power on Vancouver island, but the amount is less than they have on the mainland, and the supply on the island is less dependable owing to the danger of dry seasons.

The Canadian Collieries, Limited, have a water-power on the Puntledge river of which 10,000 horse-power has already been developed, and a further 10,000 horse-power is available for development. Of the 10,000 horse-power now developed, some 5,000 horse-power is employed at the mines, leaving only 5,000 horse-power unused. The management are considering the use of steam-power at the mines in place of electrical power on account of its greater reliability and its small cost, using coal from the mine. It is therefore possible that, if they could obtain a market for the 10,000 horse-power now developed, they might decide to make the above change. I have at present no information with regard to the price at which they would be willing to sell this power. Such an arrangement would afford an immediate supply of 10,000 horse-power, and an additional 10,000 horse-power when development-work again becomes possible.

As it appeared that the surplus developed power of the Western Power Company was controlled by the British Columbia Electric Railway Company, I discussed the situation fully with Mr. George Kidd, of the latter company, and wrote him the following letter:—

Vancouver, B.C., June 18th, 1918.

Dear Mr. Kidd,—I have been appointed, as you are aware, by the Provincial Government to obtain information in regard to the commercial possibility of smelting the magnetite ores of British Columbia by means of electrical power, and for this purpose I should be greatly obliged if you could furnish me with information with regard to the amount and cost of electrical power which it would be possible for your company to place at the disposal of any firm undertaking such operations.

In the smelting of iron ore by electrical energy, the amount of power needed per ton of pig-iron is somewhat high, being in the order of 0.4 electrical-horse-power year, and it is therefore necessary, in order to produce pig-iron commercially, that the cost of this power shall be as low as possible, and shall be considerably below the prices at which such power is sold for mechanical use.

Speaking from memory, the cost of power in Sweden, which is the only locality in which the electric smelting of iron ores has become a commercial fact, is below $10 per electrical-horse-power year, but it seems reasonable to suppose that in this Province, in view of the higher price of pig-iron and supplies generally, a somewhat higher figure would not be out of the question, say as high as $15 per horse-power year. I understand that you could not offer a figure so low as that under ordinary commercial conditions, but only by some special arrangement, as surplus power which you would not guarantee to supply for any definite length of time.

My impression with regard to the development of such a project would be that a furnace using perhaps 2,000 kw. would first be installed, and that after the experimental stage larger furnaces would be put in so as to use 5,000 or 6,000 horse-power, with the expectation of increasing the consumption to about 10,000 horse-power, or possibly as much as 15,000 horse-power. At the latter figure the production of pig-iron would be about 100 tons per day, which is, I believe, as much as would be needed in the near future in this locality.

For the commercial smelting of iron ores electrically it will undoubtedly be desirable to locate the plant ultimately at some point remote from a large city, where the power could be developed specially for this purpose at the cheapest rate and without any cost for transmission. In view, however, of the fact that the electric smelting of iron ore has not reached its final condition in regard to details of furnace-construction, and possibly even in more fundamental respects, it seems undesirable in the start to undertake a new development of power for this purpose, and the more satisfactory method appears to be to obtain power from your own or other developed system for a period of, say, four or five years, with the intention of obtaining a fresh source of power and rebuilding the plant at the end of that period.

With respect to the details of the supply, I may say that the load factor for electric iron-smelting purposes has been very satisfactory, and would probably be as high as 90 per cent. after the initial difficulties of a new plant had been overcome. I have no definite information with respect to the possibility of modifying the demand so as to avoid the peak-load of a distributing system, but in my opinion this would be possible, so that, for example, if the furnaces were using 10,000 horse-power the draught could be reduced to perhaps two-thirds of this amount during three or four hours of the day during the peak-load. It would be possible, further, to run a larger number of furnaces during the winter months, when your water-supply was ample, than in the summer months, when there might be a shortage of water, but this would, of course, reduce the output from a given cost of electrical installation.

The power factor of these furnaces has been found to be very high in Sweden, where the supply is one of 25 cycles, but in California, using a 60-cycle supply, the power factor of the furnace has been found to vary from nearly unity when the furnace is empty to as low as 65 per cent. when the furnace is ready for tapping. I should think, however, that if special attention were paid to this side of the design of furnace, it could be made to keep the power factor above 80 per cent. at all times.

With respect to the voltage of the supply, I may point out that in these furnaces the regulation is effected by a series of taps on the primary of the service transformers, there being usually three such transformers for each furnace which are independently regulated. On account of this the transformers are of special design, and the primary voltage would not be more than about 10,000, and preferably in the order of 2,000.

With regard to the location of an electric-smelting plant, I cannot speak at all definitely, but as a basis for discussion it would be satisfactory for you to take the site at Port Moody, adjacent to the present electric-furnace plant.

Further, with regard to the date at which the use of power might be expected to commence, it will require a month or two for the completion of this report and for the Government to study it, after which, if action were decided on immediately, I understand that in view of the difficulty of obtaining electrical supplies it would be necessary to allow as long as twelve months for the construction of the plant, which would thus place the possible start of operations in the fall of 1919.

I believe that the above will give you the more essential facts with regard to the possible use of electric power for smelting iron ores. I expect in the course of a week or ten days to be back in Vancouver, and will then be able to give you further information in view of the conditions which I expect to find in California. I should be very glad if in the meantime you could draw up some memorandum which would give me information in regard to the price and amount of power which might be available for this purpose and any available particulars with regard to the conditions of the supply.

I remain,
Yours very truly,
(Signed.) ALFRED STANSFIELD.

In view of the fundamental importance of the information asked for, I was hoping to receive a reply before leaving British Columbia. On returning from California early in July, I found that no reply had been prepared, and that the street-railway strike would make it impossible for the company to supply the information in the near future. I was therefore obliged to prepare my report without any definite information in regard to the price at which power could be obtained. Under the circumstances, I made the provisional assumption that some 10,000 kw. of electrical power could be obtained at a cost of $15 per electrical-horse-power year of about 85 or 90 per cent. load factor.

On September 19th, when my report was nearly completed, I received the following letter from Mr. George Kidd:—

BRITISH COLUMBIA ELECTRIC RAILWAY CO., LTD.,
VANCOUVER, B.C., September 12th, 1918.

Dr. Alfred Stansfield,
Department of Metallurgy,
McGill University, Montreal.

DEAR SIR:

Electric Smelting of Iron Ores.

With reference to your recent visit to this Province and in regard to the information then promised you respecting the supply of electric power available in the districts served by this company on the mainland and Vancouver island for the purpose of smelting iron ores, I regret that there has been unavoidable delay in submitting this data at an earlier date.

Mainland (Vancouver and Districts).—Since our representatives discussed with you the power situation there has been a very considerable change in local conditions, caused by contracts having been entered into disposing of our excess electrical energy on a surplus-power basis. Any contracts entered into would not, therefore, have to be made on a commercial-rate basis.

We would be willing to enter into short-term contracts to furnish power from 2,000 to 10,000 kw. for restricted service during this company's peak-load periods from its water-power plants at a rate of 0.5 cent per kilowatt-hour, based on a power factor of 80 per cent. Should the average monthly power factor fall below 80 per cent., then this rate of 0.5 cent per kilowatt-hour would be increased in the ratio of 80 to the actual average monthly power factor at which the furnace is operated. The minimum charge would be 50 cents per month per connected horse-power, based on the full capacity of the furnace installation.

There are two sites on the east shore of Burrard inlet which may prove suitable for an electric iron-ore-smelting plant. One of these is at a distance of half a mile north of No. 1 Power-house; the other is about five miles south of No. 1 Power-house, in the vicinity of Bidwell bay. There is no data available regarding the areas of vacant land at these places, and it is impossible to say whether sufficient level ground could be obtained.

The site half a mile north of No. 1 Power-house would be most suitable from the power-supply standpoint, and would involve the construction of only half a mile of transmission-line.

The Port Moody location, referred to by you, would be satisfactory from a rail-transportation point of view, and by the time an electric-smelting plant would be ready for operation we would probably arrange to supply the necessary power at that point.

Vancouver Island (Victoria and District).—On Vancouver island we have at present an excess of power of about 2,000 kw. which we are prepared to dispose of on a surplus-power basis at $15 per electrical-horse-power year, in blocks of not less than 500 kw. and the power factor to be not less than 80 per cent. This figure is not a commercial rate, but an experimental rate, and could only be granted for a short-term contract, and, of course, subject to peak-load restrictions and depending upon the amount of storage-water which we may have available in our reservoirs during the dry season.

This amount of power could not be reserved, and would only be available after the filling of all requirements for electrical energy for the company's use and those of its present and future customers.

In respect to available sites on the island, there are several which may be found suitable. One at Jordan river, near our power plant; another at Brentwood, on the Saanich peninsula, adjacent to our steam auxiliary power plant. Other sites might be found at Sooke harbour or near Esquimalt.

Covering both the mainland and island systems, 3-phase, 60-cycle, alternating current would be supplied at or near our existing transmission-lines, which are of sufficient capacity to supply the furnace plant; the transmission-line voltage would be 34,600 or 11,000, depending upon the location on the mainland, and 60,000 volts on the island.

I trust the above will generally cover the information desired, and should there be any further particulars needed we shall be very glad to supply same upon hearing from you in this matter.

Yours faithfully,
(Signed.) GEORGE KIDD,
General Manager.

Before leaving British Columbia I wrote the following letter, at present unanswered, with a view to obtaining further information about the supply of power from the Canadian Collieries, Limited:—

VICTORIA, B.C., July 9th, 1918.

Honourable William Sloan,
Minister of Mines, Victoria, B.C.

SIR,—In the letter to yourself of June 21st from the Canadian Collieries with regard to power for electric smelting, Mr. Savage states that he might be willing to install steam plants at each of his mines and to turn over the whole of the hydro-electric power for the purpose of iron-smelting. This would apparently supply 10,000 horse-power already developed, with a further 10,000 horse-power now partly developed.

I should be glad to learn, for the purpose of my report, at about what price per horse-power year of 80 per cent. load factor he would be able to supply these blocks of 10,000 or 20,000 horse-power for the purpose of electric iron-smelting at a point on tide-water in Comox harbour or Baynes sound.

I regret that owing to Mr. Savage's absence from the city I have not been able to discuss these matters with him personally.

I have the honour to be,
Sir,
Your obedient servant,
(Signed.) ALFRED STANSFIELD.

With a view to the future development of the electric-smelting industry, I obtained information with regard to water-powers in British Columbia that could be developed for the purpose of electric smelting. In general, it appeared that there was ample power available, and that some of these powers could be developed so cheaply as to yield electric power for smelting purposes at about $10 per continuous horse-power year. Mr. H. K. Dutcher, of Vancouver, considered that the following powers could be developed at about that cost:—

	Horse-power.
Campbell river	100,000
Cheakamus river, Howe sound	200,000
Stamp falls, Alberni	40,000

Mr. William Young, Comptroller of Water Rights, Victoria, gave me the following particulars with regard to the Campbell River and Stamp Falls power-sites:—

MEMORANDUM RE CAMPBELL RIVER POWER-SITE.

The drainage area is approximately 520 square miles; no definite precipitation data are available, but the British Columbia Hydrometric Survey report a variation from 80 inches at the mouth to 130 inches at headwaters.

Gore & McGregor's second report proposes the erection of a dam at Irene pool, mean water-level at this place being 415 feet; the power-house to be situated on the canyon, with an assumed flood-level of 98 feet. The proposed elevation of the dam is 440 feet, giving a head of 342 feet.

A constant discharge of 2,700 c.f.s. is assumed, calculated to develop 78,000 to 80,000 horse-power, with another 6,000 horse-power by storage. This discharge is, however, too high, as the mean over six years is 2,650 c.f.s., with a minimum of 450 c.f.s., and one low-water period of nine weeks below 1,000 c.f.s. On the Strathcona survey map, tracing of part of which is attached, the level of Lower Campbell lake and McIvor lake is given as 543 feet.

Stamp Falls Development—Summary of Report by Ritchie-Agnew Power Co., Ltd.

Drainage area	360 sq. miles.
Results of seven months' gaugings, continuous flow available	2,394 cu.-sec. feet.
Estimated run-off per square mile of drainage area	6 cu.-sec. feet.
Estimated storage per square mile of drainage area from short mass diagram	716 acre-feet.
Estimated mean annual run-off	2,160 cu.-sec. feet.
Storage available on Great Central lake, dam 20 feet high	307,200 acre-feet, or 853 acre-feet per sq. mile of drainage area.
Pipe-lines, three 11 feet diameter and one 7 feet 6 inches diameter	600 feet long.
Intake dam, crest length	605 feet.
Maximum height	90 feet.
Mean effective head	110 feet.
Power available based on 60 per cent. load factor, 80 per cent. efficiency factor	35,000 horse-power.
Proposed installation, three units	10,000 horse-power; 5,600 kw.
Proposed installation, one unit	5,000 horse-power; 3,000 kw.
Transmission-lines to Alberni, seven miles	12,000 volts.
Transmission-lines to Nanaimo, sixty miles	66,000 volts.

The Stamp Falls power is estimated at 35,000 horse-power on a basis of 60 per cent. load factor. As, however, an electric-smelting plant would operate at 85 per cent. or even 90 per cent. load factor, this will only correspond to about 24,000 horse-power or 18,000 kw. Such a power could be developed and utilized entirely for electric smelting. The plant could be located at or near Port Alberni, with a seven-mile transmission-line, and could obtain iron ores from the deposits around Barkley sound, from Nootka sound, and from the Renfrew district. An alterna-

tive plan would be to transmit the power about fourteen miles to Deep bay, on the east coast of the island, where ores could be obtained readily from Texada island and Redonda island.

The Campbell River estimate indicates about 84,000 continuous horse-power, or 100,000 horse-power, at 84 per cent. load factor. This would be more than could be utilized for electric smelting in the near future, and it would be necessary to develop it for use in part by some other large consumer of electric power. An electric smelter placed on tide-water within a short distance of the proposed power-house would be supplied with ore very readily from Redonda island, and also from the deposits No. 4 and No. 5 in the Quinsam Lake district.

The water-power available on the Cheakamus river is estimated at 200,000 horse-power, which is twice as large as the Campbell River power, and would need development in conjunction with other power-users. It is not situated so conveniently with regard to the ore-supplies as the powers on Vancouver island, and it may ultimately be needed for the development of Vancouver City.

With regard to the general estimate that these water-powers would yield electric power for smelting at about $10 a continuous horse-power year, it will be understood that such development would be out of the question at the present time in view of the high cost of labour and supplies and the difficulty of obtaining apparatus. In view of the present unsettled state of labour, it is useless to try to predict how long it may be before these costs become low enough to permit of economic construction, or whether costs will ever again revert to pre-war levels. It seems probable, however, that within a few years after the termination of the war, wages and costs in general will arrive at some more settled condition; and even if these are twice as high as before the war, that will not prevent construction-work, as the price of commodities generally will also be much higher than before the war and will tend to assume a definite relationship to the enhanced cost of labour and supplies.

The bearing of this consideration on the electric smelting of iron ores in British Columbia may be stated as follows: Before the war with electric power at $10, and other costs as they were then, the cost of a ton of electric pig-iron, using the Swedish process, would be between $20 and $25, leaving only a small profit, as pig-iron was selling at $25, unless a higher price could have been obtained for electric pig-iron. If, after the war, prices were to settle down at double the pre-war figures, electric power would cost $20 and pig-iron would bring $50, while labour would be about as high as at present. The cost of making electric pig-iron might be about $45, leaving the same proportionate profit as before the war. The reason which makes electric pig-iron making profitable at the present time is the temporary dislocation of prices during which the cost of pig-iron and steel has risen more rapidly than the cost of power, labour, and other supplies.

In regard to the cost of power for electric smelting, it may be pointed out that in developing a power for this purpose the turbines and electrical machinery will cost less per kilowatt-hour utilized than in the case of a power plant for ordinary power-users. This is because the load from a smelting plant can be kept almost constant for twenty-four hours daily and 365 days in the year, whereas an ordinary plant has to supply a very varying load, and so the machinery is not used to the best advantage. It follows that electrical power for smelting purposes can be developed to cost considerably less per kilowatt-hour than when developed for ordinary use.

APPENDIX V.

THE SUPPLY OF CARBONACEOUS REDUCING MATERIALS.

In the electric smelting of iron ores, carbonaceous material is needed for reducing the ore to the metallic state and for supplying carbon to the pig-iron. The amount needed varies from about ⅛ to ½ ton per ton of pig-iron produced. For this purpose either charcoal or coke may be used, but charcoal is preferable on account of its greater purity—that is, freedom from sulphur and ash—and because its physical condition renders it more suitable for electric-furnace operation. For the production of special grades of pig-iron charcoal would always be preferred,

but for ordinary grades a good quality of coke, if obtainable at a low price, might be employed on account of its smaller cost. In British Columbia, however, nearly all the coals are abnormally high in sulphur and ash, and the cost of coke produced from them is so high that there is no inducement to use it instead of charcoal in a country where timber is so abundant. While, however, charcoal should be regarded as the normal supply of reducing carbon, coke can be used to some extent in admixture with charcoal as a substitute without seriously affecting the operation of the furnace, and it can be used in this way in case of shortage of charcoal.

There is at present no large-scale production of charcoal in British Columbia, and the small quantities now obtainable cost in the order of $30 a ton, a price which would be prohibitive for iron-smelting. The production of 20 or 30 tons of charcoal daily constitutes an important industry, utilizing 50 to 70 cords of mill-waste and yielding by-products that will meet a part of the cost of operation. The problems involved are many and complicated, and before discussing them in detail it may be stated: (1) That the mill-waste of Douglas fir should be suitable for the production of charcoal for electric smelting; (2) that while the lumber-mills in and near Vancouver utilize their waste very largely, there are mills situated at more remote points from which an adequate supply of waste could be obtained at a nominal cost; (3) that the by-products from this material are not so valuable as to make it desirable to treat the wood in retorts for the recovery of turpentine, etc., regarding the charcoal as a by-product, but that it should be possible to char the wood on a large scale for the production of charcoal and still to recover a part of the by-products; such a plant would be located at or near one or more sawmills, and the charcoal would be transported by water to the smelting plant; (4) if a charcoal industry were established in suitable relationship to the lumber industry, charcoal should be produced and delivered to the smelter at a cost of about $6 or $8 per ton, corresponding to $3 or $4 per long ton of pig-iron.

An electric iron-smelting industry in British Columbia will almost certainly use charcoal, wholly or in large part, for the reduction of the iron ore. The establishment on an economical basis of a charcoal-making industry will therefore be essential to the commercial production of electric pig-iron.

METHODS OF CHARCOAL-MAKING.

Charcoal is used in some parts of the world for the production of "charcoal-iron" in small blast-furnaces. In general, hard woods are preferred for making this charcoal, because the resulting charcoal is stronger and better able to stand the load in the furnace without crushing, and because hard woods yield more valuable by-products in their distillation, which meet to a considerable extent the cost of the operation.

For the electric smelting of iron ores the strength of the charcoal is less important, because the height of the shaft is less, even in the Swedish furnace, and because, unlike the blast-furnace, no blast of air need be forced through the charge, although in the Swedish furnace there is a circulation of the furnace gases.

In Sweden the charcoal for electric smelting (as well as for blast-furnaces) is made from soft wood, and the charcoal-making is carried on at numerous points throughout the country, using in part the waste wood from the lumbering industries.

E. Arosenius (International Institute of Agriculture, Rome, January, 1918) gives some particulars of the Swedish charcoal industry. He states that the raw materials used in Swedish sawmills are soft woods, mainly Scotch pine and spruce. He estimates as follows the production and uses of charcoal in Sweden during 1913:—

	Bushels.
Forest wood charred in ovens	8,000,000
Wood-waste charred in piles	29,000,000
Wood-waste charred in ovens	1,300,000
Forest wood charred in piles (about)	75,500,000
Charcoal imported from Finland and Norway	3,300,000
Charcoal used in metallurgical works	117,300,000

For rough purposes we may assume a bushel of charcoal to weigh 20 lb., so that the consumption in Sweden must be over 1,000,000 tons. If this were all used in electric smelting it

would represent a production of at least 2,000,000 tons of pig-iron. Actually, however, a large proportion is still employed in charcoal blast-furnaces and in the production of wrought iron, for which purposes the consumption of charcoal per ton of iron is much larger.

I have not been able, in the time available, to obtain full particulars of Swedish charcoal-making, but I would recommend that such information should be obtained before deciding on the methods to be used in British Columbia.

In the Coast districts of British Columbia the largest production of any variety of timber is the Douglas fir. In 1917 some 676,000,000 board-feet of this wood was cut in these districts. The Douglas fir appears to be suitable for the production of charcoal, and I have, for my own information, made a small amount of satisfactory charcoal from a sample of this wood.

Apart from the use of "piles," which we need scarcely consider, charcoal is made in "kilns," in "retorts," and in "ovens."

Kilns.—These are large brick structures holding as much as 50 cords of wood. The heat needed is furnished by the combustion, within the kiln, of part of the volatile products and a little of the charcoal itself. A part of the by-products can be recovered, the loss of charcoal is not very great, and this is probably the cheapest method of making charcoal in cases where the by-products are of secondary importance.

Retorts.—These are small, expensive to operate, and only warranted when large amounts of valuable by-products are obtainable.

Ovens.—These are large retorts. The wood to be charred is contained in cars which are run into the ovens, and after the operation the cars, which now contain the charcoal, are run out and placed in large steel boxes where they can cool out of contact with the air. The ovens are heated externally by means of waste wood and the distillation gases. Ovens give a maximum production of the volatile by-products and the charcoal, and are largely used for charring hard wood.

In the charring of hard woods, such as beech, birch, and maple, considerable amounts of valuable by-products are obtained. These are wood-alcohol, acetate of lime, and tar. At the present time the value of these products is greater than that of the charcoal, and it pays to treat such woods in ovens in order to obtain the by-products. The soft woods have different distillation products, and it does not always pay to char them in ovens. Some of these, such as the long-leaf pine, yield considerable amounts of turpentine, pine-oils, and tar, while the production of alcohol and acetic acid is usually too small to pay for their recovery. The following is an average yield from 1 cord of pine-wood (United States Department of Agriculture, Forest Service Circular 114, 1907):—

Refined turpentine	7-12 gallons.
Total oils, including tar	50-75 „
Tar	40-60 „
Charcoal	25-35 bushels.

The turpentine is of inferior quality and the operation has often been unsuccessful commercially.

In British Columbia the Douglas fir is the wood that would probably be used for charcoal-making. Tests have been made on the production of turpentine and pine-oils from this timber, and by the use of selected resinous material considerable quantities of these products have been obtained, both by the ordinary charring process and by steam distillation—the latter being preferable for the production of turpentine and oils. The latter process has appeared particularly attractive because the oils have been found to be suitable for use in the flotation process. Careful investigation has shown, however, that the yield of these by-products from the average run of Douglas fir is so much less than is obtained from the southern pines that the process holds out little hope of commercial success. In view of this it would seem best to char the wood in the cheapest possible manner for the production of charcoal, and either to ignore the by-products altogether, or to save only such as could be obtained at slight additional expense.

Reference may be made to a paper on the "Destructive Distillation of Fir Waste," by George M. Hunt, of the Forest Products Laboratory of the United States Department of Agriculture, Madison, Wisconsin. The paper deals specially with the yields of valuable products obtained by the distillation of Douglas fir. The following is the result of a series of experiments on the destructive distillation of mill-waste:—

Table I.—Average Yields of Valuable Products per Cord of 3,800 Lb. of Douglas Fir Mill-waste.

District.	Turpentine.	Other Oils.	80 per Cent. Alcohol.	80 per Cent. Acetate of Lime.	Still Tar.	Separator Tar.	Charcoal.
	Gals.	Gals.	Gals.	Lb.	Gals.	Gals.	Lb.
Skagit County	0.8	4.4	3.9	71.1	10.7	16.3	1,072
Lake Washington ..	0.8	3.3	3.7	81.7	12.4	15.2	1,025
Grays Harbour	0.7	3.3	4.4	77.4	10.9	26.9	1,175
Hood's Canal	0.5	2.9	5.3	94.5	12.2	16.4	1,136
Average for State	0.7	3.5	4.3	81.1	11.5	18.7	1,102

The yield of turpentine and other oils is far less than is obtained from the southern pines, and the combined value of the by-products is too small to warrant the use of the expensive retort or oven process for their recovery. Mr. Hunt states:—

"In the destructive distillation of Douglas fir the value of the charcoal obtained will be more than the value of all the other products combined. Good charcoal, however, can be produced by burning in kilns and allowing the by-products to go to waste. The simplicity of a charcoal-kiln and the large units which may be employed make its first cost and subsequent operation much cheaper than the operation of a complete distilling and refining plant, and, unless the value of the extra products obtained at a complete plant is greater than the additional cost of operation, there is no advantage whatever in saving them. The yields obtained in these experiments do not show that there is any advantage."

He draws the following conclusions:—

"(1.) The steam and extraction process is not applicable to Douglas fir on account of the very low yield of turpentine and resin and the inferior quality of the latter.

"(2.) The utilization of Douglas fir stumps by destructive distillation is at present impracticable on account of of low yields and high cost of handling the raw material. The yields are practically the same as from mill-waste, which can be more readily obtained and more cheaply handled.

"(3.) The utilization of Douglas fir mill-waste by distillation has not in the past proved successful, and under present market conditions, and with the methods of distilling and refining now in use, it is of doubtful feasibility:—

"(*a.*) Because the yields are, on the whole, considerably lower than those of the southern pine and Norway pine, which are hard to distil at a profit:

"(*b.*) Because the products have not been standardized and successfully refined, and are hard to sell:

"(*c.*) Because there is only a limited market on the whole Pacific coast for wood-distillation products."

It will be seen from Table I. that a cord of mill-waste, weighing 3,800 lb. yields about 1,100 lb. of charcoal when treated in a retort. The yield in a kiln would be slightly less than this, but it seems safe to assume that 2½ cords of such waste would suffice for the production of a net ton of charcoal.

The regular charcoal-kiln is a circular brick structure holding about 50 cords of wood. It is charged and discharged by hand, and the volatile by-products are partly saved by being drawn through condensers; the permanent gases being returned and burnt in the kiln. If a battery of these kilns were established at a large lumber-mill so that the waste wood could be delivered mechanically to the kilns, the production of a ton of charcoal might cost:—

2½ cords of mill-waste at $1	$2 50
Labour and other expenses of operation after deducting the value of the by-products	2 50
Carriage of charcoal to smelter	1 00
Total	$6 00

For the electric-smelting plant about 40 tons of charcoal would be needed daily. Each kiln would yield 20 tons, but as the process is slow, requiring about fifteen days, some thirty kilns

would be needed. The consumption of mill-waste would be about 100 cords daily. The lumber-mills in Vancouver are able to dispose of their waste as firewood in the city, but it seems reasonably probable that an adequate supply could be obtained at a nominal price by locating at one or two mills away from the city. In regard to mill-waste, it should be remembered that a large part of this is "slab-wood," and this consists largely of bark, which yields an inferior charcoal. I made some charcoal from Douglas fir bark and found that the charcoal, although light and weak, was coherent, and could probably be used for electric smelting in the open-pit type of furnace in admixture with wood charcoal. The wood charcoal is extremely pure, containing scarcely any ash, but the bark charcoal from my experiment contained as much as 3 per cent. of ash. This probably indicates an appreciable amount of phosphorus, which would be undesirable when smelting for low-phosphorus pig-iron.

For the economical charring of mill-waste it seems likely that a kiln could be devised that would allow of mechanical charging and discharging, and thus reduce the charge for labour, which must be the largest item in the cost of charcoal-making. I have given some attention to the design of such a kiln, but realize that numerous problems are involved, and that much experimental work would be needed before a full-sized kiln could be constructed. The recovery of by-products can be effected very economically by the use of the Cottrell electrical-precipitation process. Dr. J. G. Davidson has made a special study of this, and expects to continue his experiments at the plant of the Electrical Turpentine Syndicate in Vancouver.

One recent process for the production of charcoal is that of W. Thomas, which depends on forcing heated distillation gases through the charge of wood. I met Mr. Thomas and visited his plant in Nanaimo, but he had not at that time any information on which I could base a conclusion in regard to the cost at which he could make charcoal. Messrs. McPherson and Fullerton Bros. have, however, carried out a preliminary test with this process, and have sent me figures from which I conclude that if mill-waste could be supplied at $1 a cord, charcoal could be made at a cost of about $6 per net ton.

In regard to the possibility of establishing an electric-smelting plant in some more remote location, such as the Campbell river, and in view of the difficulty and expense of carrying so bulky and fragile a material as charcoal, it might be necessary to cut timber specially for charcoal-making near the plant. Such timber felled, carried to the charcoal plant, and cut into pieces of suitable size would be likely to cost at least $3 a cord, and allowing 2½ cords per ton of charcoal, the wood alone would cost $7.50. Taking the net cost of charring as $2.50, after allowing for the value of the by-products, the final cost of a net ton of charcoal would be $10.

Charcoal Consumption per Ton of Pig-iron.

For the production of pig-iron in the electric furnace, I estimate on a consumption of 0.4 net ton in the Swedish furnace, or 0.5 net ton in the open-pit furnace, per gross ton of pig-iron. In view of the statement, frequently made, that only ⅓ ton of charcoal is needed, I may explain why the higher estimate should be accepted.

It is recognized that in the open electric furnace reduction of iron oxide is effected substantially by means of carbon, with the liberation of carbon monoxide, which burns above the charge and is wasted. Theoretically, 1 ton of foundry pig-iron will need 0.269 ton of carbon for its reduction from magnetite and about 0.035 ton for its carburization, assuming it to contain 3.5 per cent. of carbon. It will also need 0.026 ton of carbon for the reduction of 3 per cent. of silicon. The combined carbon requirement will thus be 0.33 ton per ton of pig-iron. On account of the well-known purity of wood charcoal, it is often assumed that it contains at least 90 per cent. of carbon, and that some 0.38 ton of charcoal will be sufficient per ton of pig-iron. Actually, however, charcoal contains from 70 to 75 per cent. of fixed carbon; the average over a long period in Sweden being 73 per cent.; the balance being volatile matter and moisture, and accordingly some 0.44 to 0.47 ton of charcoal must be provided. In view of the custom of weighing iron by the long ton and charcoal by the short ton, it appears that ½ net ton of charcoal will be required. There is, indeed, a small amount of reduction by carbon monoxide, even in the open furnace, but this will be balanced by the combustion of charcoal at the top of the furnace and the other mechanical losses. Assuming that 5 per cent. of the carbon monoxide is utilized in the open furnace and 25 per cent. in the Swedish furnace, we find that 0.4 net ton of charcoal should be enough in the latter type of furnace. Mr. Gronwall, in his estimate, quoted in my report on "Electrothermic Smelting of Iron Ores in Sweden," allows 0.370 metric ton of charcoal

per metric ton of foundry iron, and this would be 0.414 net ton per long ton of pig-iron. It will be seen, therefore, that my estimate is supported both by theoretical calculations and by the results of practice in Sweden.

I place here an account of my experimental production of charcoal from Douglas fir and of my investigation of Mr. Thomas's processes for the production of coke and charcoal.

Charcoal from Douglas Fir.

(Test made at McGill University, August, 1918.)

I was furnished by Dr. Bates, Superintendent of the Forest Products Laboratories, with samples of wood and bark of the Douglas fir, on which the following tests were made:—

I. Piece of Wood.—14 inches long, 6 inches wide, and 4.75 inches high. The piece was not square, but of the section shown. Weight, 3,375 grammes; moisture, 14.74 per cent. of dry wood or 12.85 per cent. of moist wood.

The wood was placed in a muffle-furnace and heated slowly to a temperature of 440° C. The operation lasted in all about seven hours, and it remained at the highest temperature for about one hour. When cool the charcoal came out in three pieces, it having broken transversely. The pieces put together measured 13 x 5.5 x 4 inches, or 71.6 per cent. of the original volume, and the weight was 1,134 grammes. This is 33.6 per cent. of the original weight, or 38.5 per cent. of the weight of the dry wood. The charcoal was tested by heating to redness in a covered crucible and lost 28 per cent. of its weight; as the ash is very small, this means 72 per cent. of fixed carbon. The charcoal, while not quite as dense as hardwood charcoal, was satisfactory in character, except that a part of the interior was soft and spongy. This was not due to a difference in the wood itself, as this was uniform, but to the decomposition of the issuing gases, which consolidated the outer portions of the charcoal. These denser layers varied from 0.25 to 1.5 inches in thickness, and occurred on all the surfaces. The ash in this charcoal was extremely low, being only 0.1 per cent.

II. Piece of Bark.—12.25 inches long, 6.75 inches wide, and 4.4 inches thick, of the shape shown in section. Weight, 2,595 grammes; moisture, 16.73 per cent. of dry bark or 14.34 per cent. of moist bark.

The bark was placed in the muffle-furnace and heated like the wood, except that the final temperature was a little higher, being about 500° C. Next morning it was found that air had entered through cracks and had burned part of the charcoal, which was actually ignited when taken out. The charcoal was in one piece and measured 11.25 x 6.5 x 4.5 inches, or 91 per cent. of the original volume. It will be noticed that the bark had swelled somewhat in a radial direction while charring. The weight was 882 grammes, and it would probably have been 890 grammes if no combustion had taken place; 890 grammes would be 34.3 per cent. of the original bark or 40.1 per cent. of the dried bark.

The charcoal lost 19 per cent. of its weight on ignition in a closed crucible, which would correspond to 78 per cent. fixed carbon, allowing for the ash. The ash was 3 per cent. of the charcoal.

The charcoal was light and weak, so that it would crush easily under a load; it was reasonably coherent and did not crumble very much on handling.

Conclusion.—The slow charring of Douglas fir wood yields a charcoal which, though not as strong and dense as hard-wood charcoal, would be quite satisfactory for use in electric smelting. The charcoal is extremely free from ash, from which it may be inferred that the phosphorus will be very low. The bark yields an inferior charcoal which, however, might be used in admixture with the wood charcoal. The high percentage of ash makes it probable that the phosphorus would also be high, and indicates that bark charcoal should probably be excluded in the production of specially pure low-phosphorus pig-iron.

Comparative tests were made on the density of pieces of charcoal from Douglas fir and from hard wood. The volume of each piece was determined by surrounding it with fine sand. The following results were obtained:—

	Specific Gravity.	
Douglas fir charcoal	0.394 0.363	mean 0.38.
Douglas fir bark charcoal	0.308 0.289	mean 0.31.
Hard-wood charcoal	0.441 0.486	mean 0.46.

I wish to express my thanks to Mr. Stokes, of the Forest Products Laboratories, who made the moisture determinations and prepared the pieces of wood and bark for the test.

A Note on the Walter Thomas Processes for Making Carbonized Fuel.

At the request of the Honourable Mr. William Sloan, I made a short investigation of these processes and of the plant at Nanaimo where some of them have been tested.

In general, these processes are for the purpose of producing coke from coal and charcoal from wood. The general principle employed is to heat the coal or wood in a closed vessel by passing through it hot gases obtained by distillation from the same material; these gases being heated in a pipe stove or a regenerative brick stove. The distillation products from the fuel are cooled and treated by the Cottrell electrical-precipitation process, thus obtaining oils and other condensible by-products; the permanent gases being then reheated and forced into the coal or wood, as stated above; the chief advantage to be gained being the production of certain oils which would not be obtained by the usual high-temperature distillation. Another claim is that the passage of the distillation gases through the fuel causes the deposition of carbon, and thus increases the yield and improves the quality of the coke or charcoal. It is also claimed that the operation will be more rapid, as the heat is conveyed by the gases directly into the fuel to be treated instead of by conduction through the walls of a retort.

Another process for the production of charcoal from sawdust is carried out in a revolving drum, which is heated by burning the permanent gases from the distillation in flues in the walls of the drum. The charred product is briquetted with tar, and is heated in a carbonaceous gas in such a way as to produce a very dense charcoal.

I visited the plant at Nanaimo on July 4th, 1918, in company with Mr. Walter Thomas and Mr. Wm. Brewer. The plant occupied two or three rooms in an old brewery, and consisted of the following apparatus:—

(1.) A distillation retort consisting of a vertical iron cylinder about 14 feet high and 5 feet in diameter. It was lined with bricks, so that the internal diameter was about 3 feet at the top and about 3 feet 6 inches at the bottom. The retort was intended for treating coal, which was introduced through a door in the top, while the resulting coke was withdrawn through a lateral door near the bottom. The coal rested on a perforated iron plate level with the bottom of this door, leaving a space below the plate for the removal of the products of distillation.

(2.) A pipe stove consisting of some iron pipes heated by a fire of wood, through which the permanent distillation gases passed on their way to the retort.

(3.) A condenser consisting of some water-cooled pipes for cooling the vaporous products of distillation.

(4.) A "treater-tube" or electrical-precipitation apparatus, consisting of a vertical pipe containing centrally an insulated piece of piano-wire, which could be charged to 60,000 volts, for precipitating the oil and tar vapours.

(5.) A fan or blower for causing the circulation of the gases.

(6.) A series of pipes connecting the several apparatus together, and permitting by means of valves various changes in the circulation system.

When the plant was in operation a charge of coal was placed in the retort, which was then tightly closed. The blower was started and the pipe stove heated. The air contained in the system was forced in a heated condition into the top of the retort; it passed down through the coal and passed out at the bottom, after which it passed through the condenser and the "treater-tube," and so back to the blower and again through the pipe stove to the retort. As the coal became hotter, gases would be given off, which would replace the air in the system, and thus after a time the blower would be forcing distillation gases through the stove and retort.

The plant was not in operation at the time of my visit, but had previously been tried with about 9 tons of coal from the Nicola valley. I understand that the charge of coal in the retort was about 3 tons. Difficulty was experienced in making the gas pass through the coal in the retort, using a pressure on the inlet side and a suction on the outlet side of about 10 inches of water. Oils were obtained, amounting to about 60 gallons for the 9 tons of coal, and a semi-coked smokeless fuel was obtained from the retort; but as far as could be observed there was no production of permanent gas.

The above-mentioned test was made about February, 1917, and lasted for about five weeks. Dr. J. R. Davidson, of the University of British Columbia in Vancouver, installed and operated the electrical-precipitation apparatus and supervised the whole test. I have discussed the matter with him, and he stated that the non-production of any permanent gas was inexplicable to him, as there was not enough leakage to account for it, and that in view of this it was not desirable to attempt to draw any definite conclusions.

Speaking generally, however, I may point out that the processes have the following drawbacks:—

(1.) When treating coking-coal it will be difficult to pass the gas through it at all rapidly, and the coking will consequently be extremely slow.

(2.) The circulating gases have not a great heat capacity, and a very rapid circulation will be needed to obtain even moderate rapidity of operation. This will be less serious in the case of wood than of coal, as the necessary temperature is so much lower.

(3.) The thermal efficiency of the system will be small, as much of the heat produced in the pipe stove will go up the chimney, and the fuel-consumption will in consequence be high.

(4.) The pipe stove will be costly to build and to maintain, as the pipe will burn out rather quickly.

(5.) It does not seem probable that the circulating gases will deposit carbon in the coke or charcoal, as claimed, because they must first pass through the pipe stove, which must be at a higher temperature than the fuel, and they are more likely to decompose and deposit carbon in the pipe stove. It is conceivable, however, that the coke or charcoal may in some way cause the deposition of carbon in itself, even though the gas has previously been exposed to a higher temperature.

Mr. Thomas has shown me samples of his carbonized charcoal, which is certainly a very satisfactory product. He has not, however, as far as I am aware, published or patented his method of making this dense product, and I have no reason for supposing that it can be done economically on a large scale.

In conclusion, although I am not prepared, on the information at my disposal, to recommend the processes and apparatus of Mr. Thomas for commercial operation, I recognize his ingenuity as an inventor, and think it quite likely that some of his ideas, if carefully tested and applied, may prove fruitful. Since returning to Montreal I have heard from Messrs. McPherson and Fullerton Bros., of Vancouver, who have taken over the Thomas patents and have been making some tests at the Nanaimo plant. I have received from them samples of charcoal made from fir-wood in the large retort. The operation was stated to occupy only six hours and the charcoal appears to be of satisfactory quality. I have also received from them some small briquettes made from charcoal powder by the Thomas process. They state that they can obtain mill-waste for a few cents per cord; and apparently they can make charcoal at a cost of about $5 per ton.

SUBSTITUTES FOR CHARCOAL IN ELECTRIC SMELTING.

Coal and Coke.—For the purpose of this investigation I have been furnished by Mr. Wm. Fleet Robertson and others with information with regard to the supplies of coal and coke in British Columbia. In view of my belief that charcoal will be the main reducing agent in the electric smelting of iron ores in this Province, I have not paid much attention to the supply of other fuels. Coke can be used to some extent in admixture with charcoal, and coal or oil would be needed for the operation of open-hearth and other furnaces.

The following information with regard to the supply, analysis, and price of coal and coke was supplied by Mr. W. F. Robertson under date of June 5th, 1918:—

Vancouver Island.—Monthly coal production, 145,000 tons; price per ton, $2.50 to $5.86, depending on grades. Monthly coke production, 3,000 tons; price, $10.25 per ton.

The coke contains 74 per cent. fixed carbon, 3 per cent. volatile matter, 23 per cent. ash, and 1 per cent. sulphur; but under improved conditions coke could be made that would contain 84 per cent. fixed carbon, 3 per cent. volatile matter, 13 per cent. ash, and 1 per cent. sulphur.

The following information with respect to the Nicola Valley coal was supplied to me by Mr. Nichol Thompson under date of June 10th, 1918:—

"The Nicola Valley coal produces a superior metallurgical coke with well-developed cell-structure and ample strength for iron-furnace stacks. From English coking tests the following results were obtained:—

	From Raw Coal.	Coke produced in:—	
		Bee-hive Ovens.	Retort Ovens.
	Per Cent.	Per Cent.	Per Cent.
Moisture	3.40	1.20	1.00
Volatile matter	34.90	1.20	0.50
Fixed carbon	56.70	84.00	91.25
Ash	5.00	13.60	7.00
Totals	100.00	100.00	99.75
Sulphur	0.65	0.63	0.25"

From another source in England:—

"The coal sent to me and numbered 1 is a very fine coal for metallurgical, steaming, or domestic purposes. We can take away every trace of sulphur if necessary, and it would then remain a splended metallurgical coke, supposing you had a steel plant in British Columbia. I should imagine that this No. 1 sample is about the highest-grade coal you have in Canada, and it should be used as a superior coal when British Columbia has commenced steel production. In other words, it is a coal which will find higher values as British Columbia develops. The other coal, main coal and numbered 2, seam 1, carried 38 and 40 per cent. volatile matter, and are excellent for oil and motor-spirit production, and for the production also of an excellent coke either for ordinary household fuel or for metallurgical work. The oil extracted from the coal would depend entirely on the grade of coal which you wished to produce. The coal could be distilled to destruction or any stated quantity of hydrocarbons could be left in the coke. I enclose you a sheet showing the product from 1 ton of Nicola Valley coal obtained from a by-product oven. There is no question as to the success of the by-product coke-ovens, as evidenced by the fact that the entire coal product of Germany previous to the war was made into coke so that the products might be saved."

Mr. Thompson gave me further information with regard to the chemical by-products obtainable in the coking of the Nicola coal, but it does not seem suitable to discuss these in the present report.

Gas-retort Residue.—The electric-smelting plant at Bay Point, San Francisco, employs for reducing reagent in the production of ferro-alloys a carbonaceous residue produced in the manufacture of illuminating-gas from oil. This material is practically ash-free, it contains about 70 per cent. of fixed carbon, and is obtainable at a nominal price of about $4 a ton. It is not very satisfactory physically, but in view of the scarcity of charcoal and coke in that locality the management have been obliged to use this residue and have overcome the difficulties attending its use.

Comparison of Coke and Charcoal.—The comparative values of these as reducing materials depend in the first place on their fixed-carbon content. Thus, if charcoal contains 73 per cent. of fixed carbon and coke 84 per cent., the coke would appear to be the more valuable. The remainder of the charcoal, however, is volatile matter and moisture, which is driven off harmlessly in the furnace, while the coke would contain some 13 per cent. of ash, which has to be melted, and will usually necessitate the addition of a flux. The sulphur in the coke also will need fluxing, in addition to lowering the purity of the resulting pig-iron. It follows, from these and other considerations, that charcoal is somewhat more valuable than coke as a reducing reagent. Referring to Mr. Gronwall's estimate in my Swedish report, the following figures show the relative consumption of fuel and of electric power for 1,000 kilograms of pig-iron, according as charcoal or coke are employed:—

	Using Charcoal of 73 Per Cent. Carbon.		Using Coke of 85 Per Cent. Carbon.	
	Kilos Fuel.	H.P. Year.	Kilos Fuel.	H.P. Year.
White pig-iron	340	0.37	370	0.39
Grey pig-iron	370	0.40	400	0.42

It will be clear from this table that not only is there a larger consumption of coke than of charcoal per ton of iron, but the power consumption is larger with coke.

In localities where coke is of good quality, cheap, and abundant, while charcoal is expensive and scarce, it may be worth while to use coke on account of its greater cheapness. In British Columbia, however, it appears that charcoal should be made at a cost of $6 to $8 a ton, while coke would cost about $10 a ton. As long as these conditions last there can be little doubt that charcoal will be preferable as a reducing agent in electric smelting.

APPENDIX VI.

ELECTRODES.

Electrodes are needed in most electric furnaces for conducting the electric current into the furnace. They should be good conductors of electricity and poor conductors of heat, and they should be strong and capable of withstanding high temperatures. Electrodes are usually made of some form of carbon, and their wear in the furnace, from exposure to air or to other oxidizing materials, constitute a serious source of expense. The cheapest kind of electrodes are "carbon" electrodes, which are made of some form of carbon, such as crushed anthracite coal, bonded together with pitch, and baked. "Graphitized" electrodes are obtained by heating carbon electrodes to a very high temperature in an electric furnace. The process converts the amorphous carbon of the electrode into graphitic carbon, which is a much better conductor of electricity, and is superior in some other respects. Graphitized electrodes cost about three times as much per pound as carbon electrodes, and the latter are therefore more generally used in electric smelting.

The electrodes used in the Swedish furnaces at the time of my visit in 1914 were 24 inches in diameter and 4 or 5 feet long. They were provided with threaded ends, so that fresh lengths could be added as the electrodes wore away. They were of amorphous carbon and cost about 4 cents per pound. The consumption of electrodes, when making white pig-iron from high-class ores, was about 10 to 15 lb. per ton of pig-iron; thus costing about 50 cents per ton of product. In melting lower-grade ores for foundry iron the consumption might be from 15 to 20 lb.; at present prices in British Columbia this would mean about $1.50 per ton of pig. A furnace of 3,000 kw. uses six of these 24-inch electrodes.

At Bay Point, California, the 3,000-kw. open-pit furnace, smelting ferro-manganese, uses three 24-inch carbon electrodes. The consumption is 100 lb. per ton of ferro-manganese, and Beckman and Linden expect that in using this furnace for making pig-iron the consumption would be 20 lb. per ton.

It will be noticed that the Swedish furnaces have twice as many electrodes as the Californian furnace. The size and number of the Swedish electrodes are in agreement with the generally accepted formulæ of Dr. Hering, and it seems likely, therefore, that the Californian furnace should have more electrodes if it is to be used for iron-smelting. Beckman and Linden do not agree with this suggestion, and, of course, these points must ultimately rest on practical demonstration, but it must be remembered that they have not as yet applied their type of furnace to smelting iron ores.

At Heroult, California, a 3,000-kw. ferro-manganese furnace is furnished with four 12-inch graphitized electrodes, which would be about the same in effect as the three 24-inch carbon electrodes at the Bay Point plant. Judging by the consumption of electrodes at this point, it appears that it would be preferable to use carbon electrodes, and I understand that this change will be made.

Under ordinary conditions carbon electrodes cost 3 or 4 cents per pound, but at the present time the price in the East is about 8 cents and on the Pacific coast nearly 10 cents. In view of the expense of shipping electrodes across the continent it is desirable to make electrodes locally, but this should not be undertaken until the smelting plant is in good running-order, because the manufacture of electrodes is not easy, and the use of poor electrodes might delay, seriously, the operation of the plant. Messrs. Beckman and Linden have put up an electrode plant at the Bay Point plant, and they are trying to make electrodes from the carbon residue, which they use as reducing material in the furnaces. They prepared for me the following estimates of the cost of plant and of making electrodes:—

300-ton-per-month Electrode Plant.

Baking-kilns complete, including all burning apparatus	$ 20,000
Hydraulic press (500 tons per month, 600-ton pressure)	6,000
Mixers (two)	6,000
Moulds	5,000
Calciner complete	40,000
Building complete	25,000
Crane	8,000
Conveying equipment and elevators	2,500
Crushing and screening apparatus	3,000
Kiln-sand	1,000
Tools, chains, etc.	1,000
	$118,500
Contingencies, 10 per cent.	11,850
	$130,350
Beckman & Linden Engineering Corporation fee	15,000
Total	$145,350

Cost of making 2,000 Lb. of Electrodes.

Anthracite coal, calcined, crushed, and sized	$20 00
Pitch at $20 per ton put into electrodes	5 00
Baking fuel, pound per pound ratio	4 50
Labour, 50 cents per hour	12 75
Operating superintendence	1 85
Supplies	1 00
Maintenance	2 00
Plant office expense	75
Main office expense	4 00
Total	$51 85

Cost per pound, $0.0258.

The iron-smelting plant under consideration for British Columbia was to have two 3,000-kw. furnaces making pig-iron and three 300-kw. furnaces making ferro-alloys. The consumption of electrodes in these furnaces would amount to 1,000 or 1,500 lb. daily, or about 20 or 25 tons per month. This is less than one-tenth of the output of the plant described above, and the cost of making electrodes in a smaller plant would necessarily be somewhat higher, say 3 or 4 cents per pound.

APPENDIX VII.

THE SUPPLY OF LABOUR.

Although a supply of competent labour is essential to the success of any industrial undertaking, and although the variations in the wages that must be paid may mean the difference between profit and loss, it is impossible for me at the present time to put forward any really reliable information with regard to labour conditions in British Columbia.

The Department of Labour in Victoria has furnished me, through Mr. W. Fleet Robertson, with a statement of the supply, nature, and cost of labour in the Coast District of British Columbia; this statement is added in the following pages. It will be seen that there is a fair supply of labourers at nearly $4 a day, and that most skilled men are scarce at about $6 a day. The cost of labour per ton of iron depends very much on the size and output of the plant. Thus, at the figures mentioned, in a fully equipped plant making 50 or 60 tons of pig-iron, and steel and ferro-alloys as well, the cost of labour might be $4 or $5 per ton of iron, but if only one or two furnaces were operating the labour cost might be about $7 per ton of iron.

While electric furnaces offer difficulties and dangers of their own, it appears to me that a well-established electric-smelting plant, such as those I saw in Sweden, presents far less difficulty

and discomfort to the workman than the average blast-furnace plant, and that the management should experience less difficulty in keeping a good crew of men.

On page 34 of my Swedish report it is stated that at Hagfors three 3,000-horse-power furnaces are operated by fifty men, working eight hours daily, at a wage of about 12 cents per hour. At this rate, with bonuses and the higher rates of foremen, the cost would amount to about 80 cents a ton of pig-iron. In a plant of three 3,000-kw. furnaces in British Columbia fifty men might be assumed to cost: Thirty at $4 and twenty at $6, or $240 a day. With an average output of 75 tons daily of foundry iron this would mean $3.20 per ton. A plant of this size would probably need a few additional men, say ten or twelve, which would increase the charge for labour to about $4 a ton.

Messrs. Beckman and Linden have given me a list of the men needed daily for one 3,000-kw. furnace of the open-pit type. I have added to these the rates of pay, estimated with the aid of the attached memorandum:—

Daily Labour for One 3,000-kw. Pit Furnace.

One furnace foreman at $8	$ 8 00
Twelve furnacemen at $5	60 00
One chief electrician at $6	6 00
Three sub-station operators at $5	15 00
Three mechanics at $6	18 00
Six mixing-men at $4	24 00
Six metal-handlers at $4	24 00
Two locomotive-crane men at $5	10 00
Total	$165 00

With an output of 25 tons per day this would mean $6.60 per ton of iron, which agrees with Beckman and Linden's estimate in Appendices X. and XI. This charge is unduly high, because they figured on a single furnace only. A plant having three furnaces would only need about twice as many men as a plant with one furnace, so that the cost for labour would be about $4.40 per ton.

MEMORANDUM FROM DEPARTMENT OF LABOUR, VICTORIA, B.C., JUNE 10TH, 1918.

Supply, Nature, and Cost of Labour, Coast District of British Columbia, such as would be required at Plant for Electric Smelting of Iron.

	Normal Pre-war Conditions.	Present Conditions.	
	Wages per Day of Eight Hours.	Supply Plentiful or Scarce.	Wages per Day of Eight Hours.
Engineers, 1st	About $15 less than at present	Scarce	$225 per month of 26 working-days.
Engineers, 2nd	...	Scarce	$165 per month of 26 working-days.
Machinists	$4.00 per day	Scarce	$6.00 per day.
Machinists' helpers	2.50 per day (Not quite sure)	Scarce	4.50 per day.
Boiler-makers	$4.50 per day	Scarce	6.00 per day.
Boiler-makers' helpers	3.25 per day	Scarce	4.30 per day.
Blacksmiths	4.50 per day	No great supply	6.00 per day.
Blacksmiths' helpers	3.25 per day	No great supply	4.50 per day.
Plumbers and pipe-fitters	5.00 per day	Scarce	6.00 per day.
Plumbers' and pipe-fitters' helpers	3.25 per day	Scarce	4.00 per day.
Painters	4.00 per day	No great supply	5.50 per day.
Electrical workers	5.00 per day	Very scarce	6.00 per day.
Electrical workers' helpers	3.50 per day	Very scarce	4.00 per day.
Operators of electric, steam, or air winches and donkeys	4.50 per day	Scarce	6.60 per day.
Engineers in charge of boilers	4.00 per day (Not quite sure)	Scarce	5.50 per day.
Labourers	$3.00 per day	Supply fair	3.85 per day.
Sheet-metal workers	...	Fair	6.60 per day.
Coppersmiths	...	Fair	6.60 per day.

APPENDIX VIII.

TYPE OF FURNACE TO USE FOR ELECTRIC SMELTING.

The furnaces that have been in commercial use, or that seem suitable for the electric smelting of iron ores, are:—

(1.) The Electric-Metals furnace used in Sweden:
(2.) The Helfenstein furnace tried in Sweden.
(3.) The Noble Electric Steel Company's furnace used at Heroult, California; and
(4.) The 3-phase open-pit furnace used for ferro-alloys.

The simplest of these is No. 4, the open-pit furnace. This furnace has no roof or cover and has three electrodes, which are supported from above and are surrounded with the material to be smelted. The main objection to this furnace is that heat and gases escape from the furnace and are lost, besides creating a nuisance. As far as I am aware, this furnace has not been used commercially for smelting iron ores. Nos. 2 and 3 are like No. 4, except that the top of the furnace is closed in, thus lessening the loss of heat and enabling the gases to be drawn away through flues and used elsewhere for heating. Both these furnaces have been used on a commercial scale, but full particulars of their operation are not available. No. 1 is more elaborate than the others and resembles an iron blast-furnace with an enlarged hearth. In this type, not only is the furnace closed to retain the heat and the gas from the smelting charge, but the gases are made to pass up a shaft, so as to heat and reduce the iron ore; being, indeed, returned again to the furnace for this purpose after escaping at the top. This furnace has been in successful commercial use for a number of years in Sweden, and some are now being built in other countries.

In this Appendix I give references to a number of descriptions of these furnaces, and compare the available data with regard to their operation.

I. Electro-Metals Furnace.

An illustrated account of the furnace and plant at Trollhattan, entitled "Recent Progress in Electrical Iron-smelting in Sweden," is given by T. D. Robertson in Amer. Electrochem. Soc., 1911, Vol. XX., page 375. Full illustrated reports of the work at Trollhattan by J. A. Leffler, E. Odelberg, and E. Nystrom are given in Swedish in the *Jern-Kontorets Annaler* for 1911, 1912, and 1913. Translations of parts of these appeared in *Iron and Coal Trades Review*, June 9th and 16th and November 10th, 1911, and May 2nd, 1913, Vol. 86, page 744. Articles entitled "Electric Iron Smelting" by Jens Orton-Boving appeared in the *Canadian Engineer*, December 18th, 1913, Vol. XXV., page 877, and in *Iron Age*, May 21st, 1914, Vol. 93, page 1269. The Swedish and other furnaces for the electric smelting of iron ores are described in my book, "The Electric Furnace," 1914 edition, pages 174-211, and in my report on "Electrothermic Smelting of Iron Ores in Sweden," Ottawa, 1915.

The following account of the Swedish furnace and process is from a memorandum by J. O. Boving dated July, 1915:—

"*Reduction of Iron Ore.*

"The methods and processes for obtaining pig-iron by electric reduction have mainly been worked out and put to commercial use in Sweden, but in a smaller degree the United States of America and Canada have contributed towards the experience gained. (Experiments have also been carried out in France and in Switzerland, but no commercial results have matured so far.) The reason for this is fairly obvious, as the development is based on the following cardinal conditions: Presence of cheap water-power and suitable charcoal.

"Sweden's iron trade has been based on the production of high-class charcoal pig since the earliest days of established industry, and it is chiefly on account of the high quality thus produced Sweden became famous for these products.

"Before the new processes of making steel in open-hearth and Bessemer converters were known, Sweden commanded high prices for her iron, but prices fell with the development of newer methods, and Sweden had to seek other ways in order to cheapen the cost of production and at the same time maintain the quality. Such means were found in the electric-reduction furnace. Sweden has an abundance of cheap water-power, and there are few countries in the world that have taken such beneficial advantage of it.

"The first electric-reduction furnaces were established in 1907. Now a great number of them are working and giving splendid results, as will be seen below.

"In Russia there are large districts where the conditions are similar to those in Sweden, and I am strongly of the opinion that developments could as profitably be made in the Urals, and maybe also in the Caucasus. The iron industry is already well established in the Urals. The ore is good. There is an abundance of water-power which would be easy to harness, and the supply of wood for charcoal is practically unlimited.

"As mentioned above, the development of electric reducing has been most marked during the last few years in Sweden. At present some fourteen high furnaces are in operation, and the total output represents about 140,000 tons of pig-iron per annum. This pig is of the highest quality that can be made, and it commands, therefore, high prices. It is mostly used in Sweden for producing high-grade steel, but a certain amount is also sold to the Sheffield market.

"There are, further, many more installations contemplated, and it is safe to say that wherever there is cheap water-power the old blast-furnace will be replaced by electric producers. Generaly speaking, it holds good that wherever 1 horse-power per annum can be produced cheaper than the cost of 2 tons of charcoal or coke (depending upon the class of iron to be made) it is a commercially successful undertaking to substitute electric heat for fuel-heat.

"The system of furnace which is used throughout Sweden is that patented by Electro-Metals, Limited.

"It will be seen that the furnace consists of two principal parts—the furnace-shaft and the hearth or crucible. The shaft, which is of similar design to an ordinary blast-furnace shaft (but, of course, without any blast-tuyeres), is supported independently on an iron framework or on heavy girders resting on the walls of the furnace-house. It consists of a shell of steel plates and is lined with firebrick. It is provided with a closed furnace-top, the charging-bell of which is raised or lowered by means of an electric motor and winding-drum. The hearth, which is situated immediately below the shaft, is so constructed that when it is expanded by the heat the central hole in the arch which covers it fits closely around the neck of the shaft.

"The hearth also consists of a strong shell of steel plates lined with refractory material and is covered by an arch, the weight of which may be supported entirely on the circular lining of the hearth, or else partly in this manner and partly by iron straps riveted to the shell of the shaft.

"The electrodes are preferably of circular section and provided with screw-joints for joining up end to end. They pass through the arch of the crucible at a slight inclination from the vertical. Water-cooled stuffing-boxes with asbestos packing are provided to prevent leakage of gas around the electrodes. The electrodes project into the hearth through the free space between the roof and the charge, which on descending into the hearth falls at an angle from the lower end of the shaft. The electric current is supplied to the electrodes through bronze contacts. Only carbon electrodes have, so far, been used owing to the high costs of graphite electrodes.

"The Electro-Metals furnaces are generally provided with an arrangement for gas-circulation, the gas being drawn by means of a fan from a gas outlet at the upper end of the shaft and forced through a number of nozzles into the free space between the roof of the crucible and the descending charge. The object of this gas-circulation is twofold—viz., to prevent overheating of the roof of the crucible and to facilitate the reduction process in the shaft. As regards the latter object, it is evident that the gas which becomes highly heated in the crucible assists in conveying heat to the charge in the shaft, thus extending the reduction zone and rendering it more effective through the increased volume of gas passing through.

"In this manner the percentage of CO_2 in the furnace gas can be kept higher than if no gas-circulation were used, and it is evident that this indicates a reduction in the fuel-consumption.

"The furnaces are placed in the central bay. On one side all the electrical gear is placed—transformers, switches, regulators, etc.—and this part is isolated from the metallurgical part. The power is derived from a hydro-electric plant nine miles and a half away, which power-station belongs to the company. The voltage of the line is 12,000 volts and is reduced to low pressure by transformer and adjusted by regulators to between 50 to 100 volts, as required.

"Each furnace has six electrodes, cylindrical in shape, and arranged to be used continuously without waste by using a screw-joint.

"The pouring-bay is fitted with electric overhead travellers, as well as trolly-tracks for transporting iron and slag. The iron can either be poured to pig or conveyed in ladles to the Bessemer and open-hearth furnaces. The slag is run into block moulds and makes excellent building-stone.

"The crushing-room is at the end of the furnace building. There are three crushers of the ordinary jaw type. There is a railway-track outside, and the daily requirements are supplied in the trucks, so that there is no need for large storing-bins. One of the crushers is fairly large, with wide enough jaw-space for the biggest lumps, and the ore passes from this crusher to the smaller ones, and thence by a bucket elevator to a belt-conveyor above the charging-platform, so that the raw material may be unloaded where required. There is a small ore-store, but this only contains some limited reserve amounts of the various kinds of ores used. The charcoal is transported from the stores by a ropeway.

"Three different kinds of pig-iron have been produced:—

(1.) Pig-iron for open-hearth treatment.

(2.) Pig-iron for Lancashire treatment.

(3.) Pig-iron for Bessemer treatment.

"The quality which is desired from the open-hearth pig is semi-spiegel and contains: Si, 0.40 to 0.60 per cent.; Mn, 0.30 to 0.50 per cent.; P, 0.011 to 0.018 per cent.; S, 0.015 per cent.

"It will be seen that it is more economical to produce spiegel iron in the electric furnace, and arrangements have been made to alter the open-hearth furnaces so as to use spiegel iron only.

"It has been assumed in various quarters that it would probably be difficult to maintain a constant product in an electric furnace. Experience has proved, on the contrary, that a much more constant product is obtained from the electric furnace than from the old blast-furnace. One reason for this is that there is such a large receiver or collecting-basin in the lower part of the electric furnace that it acts as a regulator on the quality.

"The Lancashire pig required is quite white and has the following analysis: Si, 0.20 to 0.30 per cent.; Mn, 0.20 to 0.30 per cent.; P, 0.011 to 0.018 per cent.; S, 0.015 to 0.020 per cent.

"During the early operation of the plant in question there was a tendency for the sulphur to be unduly high, but this was remedied by making the slag more basic whenever the furnace was run for Lancashire pig.

"The analysis of Bessemer pig used was as follows: Si, 1.00 to 1.40 per cent.; Mn, 2.50 to 3.00 per cent.; P, 0.015 to 0.019 per cent.; S, 0.005 per cent.

"Excellent Bessemer has repeatedly been made of this pig. The early attempts were not good, but it was soon found that Si and Mn had to be increased. It had been assumed that the amount would be normal, but apparently the lower temperature of the electro-Bessemer pig as compared with ordinary Bessemer pig from blast-furnaces necessitates a higher content.

"General experience points to the following results: It is cheaper to make spiegel than grey pig, because: (1) More current can be put through the furnace; (2) the current consumption is lower (per ton of product); (3) thus the production is higher; (4) the electrode consumption is lower; (5) the repair costs are lower.

"It may further be stated that rich charges give better (economic) results than poor ones. The quality of the pig however, is not influenced by the percentage of iron contents of the ore.

"For some time past the gas from the furnaces has been used as fuel in the open-hearth furnaces, and it is estimated that the value of the gas is from 2 to 3 shillings (50 to 75 cents) per ton of pig-iron produced.

"Finally, regarding the influence of the electric pig on the finished steel, experience has shown that the change tends to make better steel; this applies both to Bessemer and soft and hard open-hearth steels.

"The steel produced at Hagfors is of the highest quality and is mainly used for locomotive-boiler tubes, piano-wires, and high-tension wires generally.

"In Sweden, generally, the electric reduction of iron ore is regarded as revolutionizing this industry, and preparations are being made for constructing mills of considerable capacity. Recent experience has shown that large electrodes can be used at the same time as the current intensity on the electrodes is increased. Large furnaces will therefore be designed, and some of those now building have a capacity of 8,000 horse-power each.

"The general experience has been that the handling of the electric-reduction furnace is considerably simpler than an ordinary blast-furnace. More even quality is obtained without so careful watching. The quality can be changed easily, and the various grades from grey pig to spiegel can be obtained by simple manipulation. Less attention and less labour are required."

During the present investigation I have been in correspondence with Messrs. Electro-Metals, Limited, 56 Kingsway, London, W.C. 2, and reproduce the following extracts from two of their letters:—

Letter from J. O. Boving, June 28th, 1918.

"We have received your kind letter of the 5th inst., with regard to electric reduction of iron ore in Canada. It was exceedingly pleasant reading to the writer personally, who has for many years been in touch with various parties in Canada and could never understand why the electric reduction had not made any progress in a country where the conditions are so singularly suitable for the development of this industry. . . .

"Since you were in Sweden very great developments have taken place, and this has, of course, been especially accentuated by the war, when importation of coke has been difficult, and therefore the power existing in the country has been of greater value than ordinarily for electro-thermical operations.

"You will probably remember most of the plants you visited in Sweden, but we shall here recapitulate what has been done as far as we are acquainted up to now.

"There are two furnaces at Trollhattan—the original one and another of 3,000 kw. capacity.

"There are five at Hagfors—the two original ones and three later of 4,000 kw. capacity.

"There are three at Domnarfvet (the Helfenstein furnace was found quite useless and has been pulled out)—one of 7,000, one of 3,000, and one of 2,000 kw. capacity—and there are two more building of 3,000 kw. capacity.

"There is one at Soderfors of 5,000 kw.; one at Ljusne of 3,000 kw.; two at Porjus of 3,000 kw.; and three at Lulea of 3,000 kw.

"Some have been built in Norway, two in Switzerland, and two or three in Japan.

"The most important plant we have tackled is, however, the one in the Aosta valley, North-west corner of Alpine, Italy. Here we are erecting for the firm of Ansaldo & Co. (the largest armament firm of Italy) a reduction plant consisting of six units each of 3,000 kw. capacity. Two of these furnaces will be run on charcoal and four on coke. Half of the furnaces are built here and the half to our drawings in Italy.

"We are going to work out a revised estimate of the cost of this plant as applied to Canadian conditions and send along as soon as possible. This will give you a good idea of what you could look forward to. We shall also give you data regarding power-consumption, electrodes, labour, charcoal, and other supplies.

"Whilst we write you about reduction-furnaces, we think it is only right that we should inform you about the most remarkable developments which have been achieved with our steel-furnaces.

"The electric steel-furnace is undoubtedly the easiest apparatus existing to-day for melting steel and purifying it afterwards. The great flexibility of the electric heat and the possibility of applying it at the right point makes the removal of impurities, such as phosphorus and sulphur, and further complete deoxidation a very easy matter, and steel-makers in Europe are now unanimously of the opinion that as soon as the war is over electric furnaces will be installed by all large steel-mills, even for ordinary grades of steel. The process will be that whilst open-hearth furnaces and Bessemer converters will be maintained, these will only be used for taking the steel a certain part on the way towards perfection, and the final touch up will be made in the electric furnace. Treating molten steel in the electric furnace and refining it from impurities requires for a large unit between 80 and 100 kilowatt-hours per ton. This consumption is not prohibitive even under conditions such as are prevailing in this country, where power under ordinary conditions is available at a price of about one-third of a penny (0.7 cent). But it is a remarkable fact that even now during the war, when price for power ranges from 1 to 2 cents per unit, certain manufacturers, such as Brown-Bayley, Hadfield's, Cammell-Laird, and the Partington Steel Works, find it profitable to use our electric furnaces for treating ordinary carbon steel, starting from the cold. It should be, of course, remembered that this can only be done in fairly large furnaces having a capacity of at least 5 tons, because the current consumption increases very rapidly for small units. Thus, whereas a 1-ton furnace requires about

1,200 units for melting and refining 1 ton of scrap, a 5-ton furnace only requires about 750 units for the same work, and a 10-ton furnace round about 600 units.

"When we come to consider electric furnaces receiving their power from hydro-electric installations, the question comes into quite a different plane. In many cases it is possible to supply the current at the rate of 0.1 cent, and the price of the total current consumption is thus so reduced that the whole process compares very favourably with the most economical coal-gas-fired open-hearth furnaces.

"In connection with Messrs. Ansaldo's Reduction Works a large steel-works is also being installed. The rich gases from the reduction-furnaces are used in the steel-works, but there will also be a battery of ten 15-ton electric steel-furnaces, all energized by water-power. You may be interested to know that Ansaldo's metallurgical engineer is Professor and Dr. Giolitti (of carburizing-of-steel fame), and their steel-works are regarded as obtaining higher quality results than any other works.

"On the coast of Norway there are also a number of electric steel-furnaces energized by water-power, and these undertakings are paying extremely well, turning out fine steel and making huge profits."

Letter from J. Bibby, September 21st, 1918.

"The production costs given in our letter of August 19th (*see* Appendix X.) are for the manufacture of white pig-iron as you surmise, and these are to be obtained in the large plant at Messrs. Ansaldo's about which we wrote you. For the manufacture of grey foundry pig-iron in this large plant the consumption will be approximately 0.37 horse-power year per ton of pig-iron, assuming that the ore contains between 65 to 70 per cent. of iron.

"For a plant consisting of only one 4,000-horse-power furnace, for instance, the consumption would be from 5 to 10 per cent. higher, as the diversity factor would be greater. For the case you mention of 9,000 tons per year you could assume a consumption of 0.41 horse-power year per ton of grey iron produced from ore containing 65 per cent. of iron.

"With reference to the sintering mentioned on page 4 of your letter, it is quite a common practice in Sweden to employ as much as 50 per cent. sintered and 50 per cent. lump ore and obtain satisfactory results.

"With reference to the price of current in British Columbia, wo do not see why the cost there under similar circumstances should greatly exceed what is being done in Sweden, where current is being regularly supplied at the equivalent of $8 per horse-power year. The electric suppliers must take into account the favourable nature of an electric-furnace load as regards power factor and load factor. Under the circumstances you give of a 60-cycle supply running one furnace, the power factor would be as high as 0.92.

"With reference to charcoal, we are in a position to supply drawings and specifications for charcoal plants to suit any given requirements, and if desired we could quote you a fee for this work.

"We are pleased to learn that you are contemplating a new edition of your valuable book on electric furnaces, and we believe that you will consider a description of our recent developments worthy of notice. We are therefore preparing a description of the various improvements we have made since your book was published, and will send this on to you in due course. These improvements consist in the employment of a new 2-phase system for small furnaces up to 7 tons, and a new 4-phase system for furnaces between 7 and 30 tons capacity. We have also made improvements in the way of automatic regulators, electrode economizers, etc., all of which we will give you particulars. In the meantime we enclose you two electrical diagrams which no doubt will be quite clear to you.

"As regards the 6-phase arrangement, this is applied to our 3,000-kw. reduction-furnace. As before, we employ three transformers which each supply two diametrically opposite electrodes, but we so connect the transformers that we obtain six independent phases in which the relationships are definitely fixed."

In conclusion, I may say that the Electro-Metals furnace is undoubtedly the most efficient appliance that has so far been applied to the electric smelting of iron ores, but that in view of the large consumption of power by even this type of furnace it will be unwise to put up an elaborate plant of this kind unless an adequate and permanent supply of electric power can be obtained at a moderate price.

Unfortunately, some of the earlier reports gave exaggerated ideas of the economy of electrical power and charcoal that had been obtained with these furnaces, and I myself made the mistake of taking these reports literally when writing the 1914 edition of my book on "The Electric Furnace." After visiting Sweden and investigating the conditions obtaining there, I arrived at more conservative figures as put forward in my 1915 report. In Mr. Bibby's letter of September 21st, quoted above, he states that with a single furnace of 4,000 horse-power producing 9,000 tons per annum, the consumption would be "0.41 horse-power year per ton of grey iron from an ore containing 65 per cent. of iron." It will be obvious that from the available ores, which do not contain more than 55 per cent. of iron, the figure I am assuming of 0.45 horse-power year will not be too high.

Although the Swedish furnace is more economical than any other electric ore-smelting furnace, there still remains a considerable margin for further possible improvement, and I hope that some process of low-temperature reduction of iron ores may be worked out which will show a decided improvement over the Swedish process.

II. The Helfenstein Furnace.

The Helfenstein furnace was originally devised for the production of calcium carbide and ferro-silicon. (*See* R. Taussig, Faraday Society, V., 1910, page 254; Soc. Chem. Ind., XXXIX., 1910, page 435; Met. and Chem. Eng., X., 1912, page 686.) A 10,000-horse-power furnace of this type for iron-smelting was started at Domnarfvet in May, 1913, and was in experimental operation at the time of my visit in 1914. A more recent account appeared in *Iron and Coal Trades Review* (London), February 23rd, 1917, and in *Met. and Chem. Eng.*, May 1st, 1917, page 509, from which I have taken the following particulars:—

When charcoal was used, the consumption of power, etc., was 2,170 kilowatt-hours, 380 kg. charcoal (70 per cent. carbon), and 5 kg. of electrodes per metric ton of pig-iron. When coke was used, the consumption was 2,600 to 2,700 kilowatt-hours, 310 to 320 kg. of coke, and 4 kg. of electrodes. The consumption of 2,170 kilowatt-hours with charcoal corresponds to 0.392 horse-power year at 85 per cent. load factor. This is probably for the production of white iron from high-grade ores, though at the time of my visit ores of 50 per cent. iron were being smelted. It does not appear that the efficiency is any better than that of the Electro-Metals furnace, and it should be noticed that the use of coke causes the consumption of a far greater amount of electrical power.

The idea of this furnace is to increase the output and efficiency by using a far larger amount of power in a furnace of a given size than was possible in the Electro-Metals furnace. The furnace gases were not used to reduce the ore in the furnace, but were employed for other purposes in the plant. It is unfortunate that we have no detailed account of the operation of this furnace, or of the reasons which caused it to be abandoned.

III. The Noble Furnace.

At Heroult, in California, electric smelting of iron ores was undertaken in 1907, and was continued, experimentally, until about 1914. The first furnace was designed by Paul Heroult, and was a 2,000-horse-power rectangular furnace, with three vertical electrodes alternating with four vertical chutes for supplying the ore charge. The furnace had an arched roof and the chutes were heated by the escaping gases. The chutes became choked with the heated ore, the roof broke down or melted, the furnace could only be worked with an open top, and was finally given up. Professor D. A. Lyon experimented in 1908 with a single-phase furnace of 160 kw., and in 1909 put up a furnace of 1,500 kw., substantially like the earlier Swedish type of furnace. Work with this furnace was continued until 1911, when it was finally given up, possibly on account of difficulty in controlling the nature of the product. The Noble Company then reverted to the rectangular type of furnace, using four electrodes and five charging-chutes, which, however, were not heated. A 2,000-kw. furnace was built in 1911, and an additional furnace of 3,000 kw. in 1912 or 1913. The best account of this furnace was written by John Crawford, the plant manager, in *Met. and Chem. Eng.*, July, 1913, Vol. XI., page 383.

Mr. Crawford states that the tall-shaft furnace built in 1909 could probably have been made economically efficient, but that it could not be made to respond readily to changes in the burden, as would be essential for making consistently high-grade foundry iron. He explains the necessity in electric smelting of controlling accurately the addition of carbon in the charge, as an excess

of carbon cannot be burnt off as in the blast-furnace, and a deficiency results in low-grade iron. This difficulty of controlling the amount of carbon does not interfere with the production of a low-silicon iron—such as is used in Sweden—but in his experience it caused great difficulty in the production of foundry iron. In view of this the shaft-furnace was abandoned, and a 2,000-kw. 3-phase furnace of the long and narrow type was tried. This furnace had four electrodes, delta-connected and suspended between five charging-stacks. He considers that this type of furnace, which was operating in 1913, is the one best adapted to their needs. The second furnace of this kind, having 3,000 kw. capacity, consists of a rectangular steel shell 28 feet long and 10 feet wide, lined with standard firebrick. This is surmounted by five charging-stacks 18 feet high, and between the stacks the top of the furnace is arched over. The electrodes are of Acheson graphite, 12 inches in diameter, and enter vertically through the arch between each adjacent pair of charging-stacks. The furnace gases are not used for preheating or reducing the ore, but are led away and used under lime-kilns and charcoal-retorts. The electric current is supplied to the furnace at a voltage of from 40 to 80. He found that coke was less satisfactory than charcoal in this furnace, but that if the coke was crushed a mixture of 60 per cent. coke and 40 per cent. charcoal could be used with fair efficiency. The following is an analysis of a 200-ton lot shipped to a foundry for making steel castings:—

	Per Cent.
Silicon	2.88
Combined carbon	0.09
Graphite carbon	3.38
Sulphur	0.028
Phosphorus	0.031

Mr. Crawford does not consider this type of furnace as efficient as the shaft type, but states that he has kept the power-consumption as low as 2,200 kilowatt-hours per ton of pig in a furnace of 300 kw. This would equal 0.40 horse-power year at 85 per cent. load factor. He states, however, that the long and narrow type offers the possibility of building several furnace units on to each other, like copper blast-furnaces, and this would lessen the radiation and electrical losses and increase the efficiency. It would also enable part of the furnace to be repaired while the remainder was still in operation.

Since Mr. Crawford's article scarcely anything has been published about the Noble smelting-furnace, but I learn that the production of pig-iron was discontinued about the year 1914. This may not have been caused by any technical difficulty, because the commercial situation at Heroult, which can never have been very good, became impossible when the charge for power was raised from $12 to $25 per horse-power year. The plant is situated on the Pitt river, in Shasta County, and is reached by an independent line of rails from Pitt Station, on the Southern Pacific Railroad. The iron ore is about the only element of their supply which can be obtained cheaply at the works; there is not enough timber left near the plant for charcoal-making, and wood for this purpose has to be brought in by rail. All their general supplies and their products have to be shipped over two railroads from or to San Francisco or other industrial centre.

IV. The Open-pit Furnace.

For the production of calcium carbide and ferro-alloys a simple type of open-topped furnace has been developed, and this is recommended by Messrs. Beckman and Linden for the smelting of iron ores. The 3,000-kw. furnace erected by this firm at Bay Point for the production of ferro-manganese may be taken as typical. It consists of a rectangular steel box, about 17 feet long, 9 feet wide, and 7 feet high, suitably braced outside, and lined around the sides with 4½ inches of firebrick. The bottom lining is about 3 feet thick, composed of blocks of carbon, and the furnace is supported on piers to permit of air-cooling. The top of the furnace is open, and the three electrodes, which are of amorphous carbon, hexagonal in section, 24 inches in diameter and 7 feet long, are hung in the middle line of the furnace, being spaced 3 feet 6 inches apart from centre to centre. The lower ends of the electrodes are surrounded and covered by the ore and other materials when the furnace is operating. The upper ends of the electrodes are held by water-cooled metal-holders, which support the electrodes at the correct height and supply the electric current to them. The height of the electrodes is controlled and regulated by automatic machinery, which is designed to keep a constant electrical load on the furnace. Three-phase electrical power at 22,000 volts is supplied to three 1,000-kw. transformers, from which the working-current, at 70 to 100 volts, is led by flexible conductors to the three electrode-

holders. A charging-platform extends around the furnace about 3 feet below the top, and the mixture of ore, carbon, and flux is shovelled into the furnace from this platform. The molten ferro-manganese and slag are allowed to run out of the furnace periodically by means of a spout and tapping-hole opposite the centre electrode.

There can be no question that charcoal pig-iron of any desired grade can be made in this kind of furnace, which is easily and cheaply built and repaired, and should be able to run for a long time without need of repair. By providing an ample supply of power the efficiency should be satisfactory, and may be expected to approach fairly closely to that of the Swedish furnace. The charcoal-consumption will certainly be higher, but, as a poorer quality charcoal can be used, this need not cause any additional expense. The power-consumption will probably be higher; but it is impossible to speak positively on this point, because the loss in heat, due to the open top and the absence of a stack, may be largely balanced by the greater efficiency of a higher-powered furnace, and by the fact that stoppages for repairs will be fewer and less prolonged. The consumption of electrodes will probably be larger per ton of pig-iron, because they are somewhat exposed to the air, and perhaps also on account of the greater current density used in these electrodes. Although, in general, the furnace has much to recommend it as a simple and effective means for making iron, it must be remembered that the furnace gases are allowed to burn above the charge; thus not only are they wasted, but they create a serious nuisance. It is difficult to avoid the conclusion that, in operating such a furnace for the commercial production of pig-iron, the management would ultimately be obliged to close in the furnace-top, so as to remove the gases from the furnace-room, even if the value of the gases were neglected. The furnace, so closed in, would then resemble the Helfenstein or the Noble furnace, already described. If, then, it is decided to smelt in an electric furnace other than the Swedish type, it would be practicable to start with a simple pit furnace as used for ferro-manganese, and to add to this, if it seems desirable, provision for retaining the heat and gases and supplying the charge in a more mechanical manner.

If it is found practicable to reduce the crushed ore to a metallic powder in some gas-fired furnace, this powder can be melted down very simply and cheaply with additions of carbon and ferro-silicon to produce foundry pig-iron. A simple electric furnace provided with a cover will probably be the best for this purpose.

APPENDIX IX.

DESIGN AND COST OF PLANT FOR THE ELECTRIC SMELTING OF IRON ORES.

General Considerations.

(1.) We have seen that in view of the limited market it is undesirable at present to consider the production of more than 20 or 30 tons of pig-iron daily for use in foundries.

(2.) The cost of production on so small a scale would be very high, and, as there will not be a great profit in making pig-iron, it seems doubtful whether a plant of that size could pay its way under ordinary conditions.

(3.) If, however, we include in the plant furnaces for the production of steel and ferro-alloys, which can probably be made with a greater profit, and apart from this will help to carry the general overhead charges, there is more probability that the plant can be made to operate at a profit.

Electro-metals Plant.

Messrs. Electro-Metals, of London, are installing an iron-smelting plant for Messrs. Ansaldo & Co. in the Aosta valley in Italy, and I have received from them the following estimate of the cost of building a similar plant in Canada.

The plant would consist of six electric furnaces of the Swedish type, each using 3,000 kw. and producing 10,000 tons of pig-iron a year. This is for the production of a low silicon or white pig-iron from an ore of about 65 per cent. iron. The plant would consist of a large furnace building, divided lengthwise into three bays. One of these contains the transformers and other electrical apparatus, the central bay would contain the six electric furnaces, and the remaining bay would be devoted to the disposal of the pig-iron and the slag. Besides these, there would

be a storage-house for the charcoal, and stores for electrodes and other supplies, with bins or storage-space for the ores, fluxes, and pig-iron. No mention is made of unloading piers or wharves, or of railroad-tracks, or of the land on which the works would be erected, and it seems probable that further charges should be made for these.

The plant of 18,000 kw. is estimated to cost:—

Six shafts complete with charging-bells and pipes	$170,000
Twenty (1,000 kw.) transformers (two spares)	150,000
Switch-gear	40,000
Elevators	15,000
Pumps and water plant	40,000
Blowers, fans, and ducts	20,000
Motors	5,000
Buildings	100,000
Total	$540,000

This is equal to $9 per ton of yearly output.

For present consideration we may take a plant, producing pig-iron alone, of half this size; that is, of 9,000 kw. This would make more pig-iron than we need, but would be of about the right effective size and expense. Such a plant, with additional charges for the land, unloading-wharf, tracks, and rolling-stock, would cost in the order of $350,000 to $400,000. The estimated output for this would be 30,000 tons per annum, but this should be corrected (1) for the ore being of 53 per cent. iron instead of 65 per cent., which will probably reduce the output from 30,000 tons to 26,000; (2) a further correction, in view of the production of foundry instead of white iron, will reduce it to 24,400 tons, or 8,100 tons for each of the three furnaces.

It is probable, however, that the estimated output of 60,000 tons from a six-furnace plant was a conservative figure, and it appears reasonable to assume an average daily output per furnace of 25 tons of foundry iron, even from the low-grade ores of British Columbia. Twenty-five tons a day per furnace would be 9,000 tons per annum for each furnace, or 27,000 tons for the whole plant, and I shall base my calculations on this.

By way of comparison, I add an estimate, made for me in 1914, of the cost of building in Canada a 9,000-kw. plant of the Swedish type. The estimate was prepared by Mr. Assar Gronwall, of Ludvika, in Sweden. It is probable that the firm have introduced some economics since the date of this estimate, but the cost of construction, especially in British Columbia, has increased rapidly, and it seems likely that a complete plant, including land, wharf, and rolling-stock, will cost in the order of $400,000, or $15 per yearly ton of output.

Plant of Three Electric Furnaces of 3,000 Kw. each.

Excavation, levelling, railway-tracks, store-house for ore and coke or charcoal, foundations for buildings and furnaces	$ 30,000
Buildings—	
House of light iron construction for three furnaces	60,000
Crusher-plant house, laboratory, inclusive of appliances, workshop for repairs, and storehouse, and various smaller shops	12,000
Furnaces—	
Three furnaces at 4,000 horse-power, with fans and gas-pipes	75,000
Electric transformer instruments with low-tension conductors	100,000
Moulds, ladles, tools, and instruments	10,000
Travelling crane of 5 tons capacity	6,000
Ore-crusher, apparatus for transporting crushed ore to the furnace-top	7,000
Side-tracks for transport and other transporting devices	7,000
Water-pipes and waste-pipes	5,000
Drawings, supervision during construction, and unforeseen expenditures	48,000
Total	$300,000

If the Electro-Metals type of furnace is used there would probably be only two of these built, and the remaining power would be devoted to the production of ferro-alloys and to steel-making.

PLANT WITH OPEN-PIT FURNACES.

I visited in California a plant at Bay Point, San Francisco, and another at Heroult, in Shasta County, where ferro-manganese and other ferro-alloys are made in electric furnaces. The largest furnace used was a rectangular open-pit furnace, using 3,000 kw. and having three 24-inch carbon electrodes which are suspended in the furnace. Messrs. Beckman and Linden, who built and operated the plant at Bay Point, consider that furnaces of this type would give entire satisfaction for the production of pig-iron, and that such furnaces would have the added advantage that they could be employed at any time for the production of ferro-alloys. These furnaces would undoubtedly be cheaper to build and the repairs would be less costly, but, on the other hand, they would also certainly be less efficient than the Swedish furnaces. Messrs. Beckman and Linden prepared for me an estimate of the cost of a plant of this type, having one 3,000-kw. furnace for the production of pig-iron and other smaller furnaces for ferro-alloys. I have changed a few of their figures to provide for the construction of two 3,000-kw. furnaces.

7,000-kw. Plant for Pig-iron and Ferro-alloys.

Two 3,000-kw. 3-phase furnaces, installed, including casing, electrode-holders, jib-cranes, regulators, and foundations	$ 30,000
Seven 1,000-kw. single-phase, 33,000-volt primary, 60-cycle oil-insulated and water-cooled transformers, installed, with from 60 to 120 volts in 5-volt steps on the secondary side (one of these transformers is spare), at $6,500	45,500
Two sets low-tension busses for 3,000-kw. furnaces, installed	10,000
Two sets high-tension busses for 3,000-kw. furnaces, including oil-switches, switchboard, and meters	12,000
Three 300-kw. furnaces, single-phase, installed, including casing, electrode-holders, and regulating device	10,000
Four 300-kw. 33,000-volt primary, 60-cycle, single-phase, oil-insulated and water-cooled transformers, installed, with a range of from 70 to 100 volts in 5-volt steps on the secondary side	10,000
Three 50-kw. single-phase, 60-cycle, 33,000 volts to 440 volts, air-cooled transformers, installed, with switchboard (to be used for industrial purposes around plant)	2,000
One 25-kw. motor-generator set for regulators, etc., installed	2,000
Three sets low-tension busses for 300-kw. furnaces	1,500
One furnace building, built entirely of reinforced concrete, including electric travelling crane, tracks, metal-handling equipment, etc.	45,000
One transformer building, built entirely of reinforced concrete	13,000
One shipping-store building of wood and stucco exterior finish	7,000
One laboratory with complete equipment	7,500
One store-room and change-room building, built of wood and exterior stucco finish, including steel lockers, toilets, wash-basins, and shower-baths	8,000
One machine-shop with equipment	10,000
One office building	3,000
One gate-house with time-clock and time-keeper's office	500
Railroad-tracks, industrial track, ore-handling equipment, water-supply, sewerage, fence, and industrial lighting, etc.	25,000
Land, 4 acres	4,000
	$246,000
Engineering and contingencies, 20 per cent.	49,200
Total of Beckman and Linden's estimate	$295,200

Brought forward	$295,200
Additional items—	
Dock with unloading locomotive, crane, etc.	30,000
Charcoal storage	8,000
3- to 10-ton ladles for handling metal	6,000
Flues and stack	25,000
Total	$364,200

Say a total of $350,000.

In the above list I have added to Messrs. Beckman and Linden's estimate a few items that should apparently be included. A dock and unloading plant would be needed for economical operation on a large scale, a storehouse would be needed for the charcoal, and it will probably be desirable to use large ladles for handling the molten metal. In the plant at Bay Point the furnace gases escape and burn in the furnace-room, creating a very serious nuisance. I would advise the construction of suitable flues and stack for the removal of furnace gases and the collection of the dust blown out by the furnaces. These flues can be placed below the charging-platform.

The above estimate represents the cost of a complete plant having one furnace making foundry iron for sale, a second making white iron for steel-making, and three smaller furnaces for ferro-alloys. As, however, we are considering in the first place the cost of production of pig-iron alone, I have rearranged the estimate for this purpose, so as to represent a plant of 9,000 kw. making foundry iron in three 3,000-kw. furnaces. This estimate should then be comparable with the Swedish estimates for a 9,000-kw. plant.

Beckman and Linden's Estimate modified for a 9,000-kw. Plant making Pig-iron.

(For details *see* previous estimate.)

Three 3,000-kw. furnaces	$ 45,000
Eleven 1,000-kw. transformers (two spares)	71,000
Three sets low-tension busses	15,000
Three sets high-tension busses	18,000
Three 100-kw. transformers, etc.	3,000
One 25-kw. motor-generator, etc.	2,000
One furnace building, etc.	35,000
One transformer building	15,000
One shipping-store	7,000
One laboratory	7,500
One store-room	8,000
One machine-shop	10,000
One office building	3,000
One gate-house	500
Railroad-tracks, etc.	25,000
Land	5,000
	$270,000
Engineering, etc., 20 per cent.	54,000
Total from Beckman and Linden's figures	$324,000
Additional items—	
Dock, etc.	30,000
Charcoal storage	8,000
3- to 10-ton ladles	6,000
Flues and stack	25,000
Total	$393,000

The corresponding figures, derived from the Swedish estimate, were between $350,000 and $400,000, but this does not mean that the Swedish furnace is the cheaper, as the estimates differ in completeness and are based on different conditions. We may, however, conclude that a com-

plete plant using 9,000 kw. for the production of pig-iron would cost about $400,000. It would appear certain that with an equal completeness of construction the Swedish plant would be somewhat more costly than the other, and for further calculation we may assume the cost of a Californian plant of 9,000 kw. to be $400,000, and of an equally complete Swedish plant $450,000.

In order to obtain an independent judgment in regard to the general arrangement and cost of an electric-smelting plant in British Columbia, I discussed the design with Mr. R. H. Stewart, of Vancouver, and he contributed some general considerations in regard to the design and cost data for the general portions of the plant, exclusive of the electrical furnaces and appliances.

The design was for a plant of 20,000 horse-power (15,000 kw.) for the production of 100 tons of iron daily and 20 tons of ferro-alloys. The plant was designed to handle daily the following quantities:—

	Tons.
Iron ore	200
Charcoal	50
Limestone	20
Electrodes	2
Manganese ore	20
Quartz	10
Chrome ore	10
Scrap-steel	20

Although the plant as a whole was based on a daily capacity of 100 tons of iron and 20 tons of ferro-alloys, the electrical and furnace equipment is only about half of this, corresponding to a consumption of 10,000 horse-power or 7,500 kw., and a production of 50 tons of pig-iron and 5 tons of ferro-alloys: provision being made for extension at a later date.

The furnace building would be 50 feet wide, 30 feet high, and 150 feet long. It would contain along one long side two 3,000-kw. open furnaces for smelting iron ore and three 300-kw. open furnaces for ferro-alloys. On the other side of this wall would be the transformer building, 30 feet wide and 30 feet high. The supplies of ore for the furnaces would be delivered by an elevated track in front of the furnaces and level with the charging-platforms. The furnace gases would be removed by flues below the charging-platforms. The pig-iron could be tapped into large ladles and cast in sand or in a casting-machine or poured direct into a Bessemer converter for steel-making. The ores and other supplies coming by water would be unloaded into storage by a locomotive crane. The charcoal would need a large storage-shed, perhaps 300 feet long and 90 feet wide, which would contain a month's supply, stored not more than 10 feet deep.

The order of operations would be as follows:—

(1.) Unloading from the dock directly into storage.

(2.) Removal from storage, using the same crane, to crushing and sampling plant.

(3.) Removal from crushing plant to the furnace charge-bins.

(4.) Delivering from charge-bins over weighing-hoppers to the charge-cars and thence to the side of the furnace.

(5.) Smelting for pig-iron or ferro-alloy.

(6.) Molten pig-iron received in ladle and handled by crane to casting-bed or casting-machine or to steel-making furnace.

(7.) The slag would be received in a ladle and removed by a locomotive.

The following is based on Mr. Stewart's estimate for the cost of buildings and general plant. Items for the furnaces and electrical equipment have been added from Messrs. Beckman and Linden's estimate:—

20,000-h.p. Plant with 7,000 Kw. of Electric Furnaces and Equipment.

Mr. Stewart's items—	
Locomotive crane, buckets, and grab-buckets	$ 19,000
Dock, say	10,000
Electric locomotive, cars, and equipment for handling between the wharf and the crushing plant	10,000
Crushing and sampling, say	17,000
Charcoal storage for one month's supply	8,000
Carried forward	$ 64,000

Brought forward	$ 64,000
Tracks, etc., for the above-mentioned equipment	3,500
Lifting-magnet for steel scrap, etc.	1,200
Storage of manganese ore	3,500
Storehouse for electrodes and other supplies, including a small crane	6,000
Six furnace charging-bins, including weighing-hoppers and mechanical feeders	9,000
Tracks, charge-cars, and locomotive, with supports for the overhead track	10,000
Furnace building, including crane runway	25,000
Transformer building	12,000
3- to 10-ton ladles	6,000
Flues and stacks	25,000
20-ton crane, 50-foot span	18,000
Laboratory and equipment	6,000
Office	5,000
Machine-shop and blacksmith's shop	12,000
Wash-house and change-room	3,000
Slag-handling equipment	8,000
Items from Messrs. Beckman and Linden—	
Two 3,000-kw. 3-phase furnaces, installed	30,000
Seven 1,000-kw. single-phase transformers	45,500
Two sets low-tension busses for 3,000-kw. furnaces	10,000
Two sets high-tension busses, etc., for 3,000-kw. furnaces	12,000
Three 300-kw. single-phase furnaces, installed	10,000
Four 300-kw. transformers, installed	10,000
Three 50-kw. single-phase transformers	2,000
One 25-kw. motor-generator set for regulators	2,000
Three sets low-tension busses for 300-kw. furnaces	1,500
Land, say	6,000
Engineering and contingencies, 20 per cent. on $129,000	25,800
Total	$372,000

Modifying this estimate to represent a plant of 9,000 kw. making pig-iron only, we have:—

9,000-kw. Plant for Pig-iron.

Mr. Stewart's items	$217,000
Three 3,000-kw. furnaces	45,000
Eleven 1,000-kw. transformers	71,000
Three sets low-tension busses	15,000
Three sets high-tension busses, etc.	18,000
Three 100-kw. transformers	3,000
One 25-kw. motor-generators	2,000
Land	6,000
Engineering, etc., 20 per cent. on $160,000	32,000
Total	$409,000

These figures agree with the previous estimate of $400,000.

Design and Cost of Complete Plant.

The foregoing estimates of the cost of a 9,000-kw. plant for making pig-iron are for use in calculating the cost of smelting pig-iron. Any plant actually constructed would be more complex in nature, as it would include furnaces for ferro-alloys and for steel-making.

Such a plant, as has already been indicated, might suitably contain:—

Two 3,000-kw. furnaces making pig-iron.

Three 300-kw. furnaces making ferro-alloys.

This plant will produce daily about 25 tons of foundry pig-iron and about 30 tons of white pig-iron for steel-making, together with about 3 tons of ferro-alloys. The plant would cost in the order of $370,000.

To make the plant complete and self-contained, there should be added electric or other furnaces for making steel, and a steel-foundry and rolling-mill for handling the steel so produced.

I have obtained from Mr. W. G. Dauncey approximate figures for the cost of a steel-foundry and rolling-mill. This plant would handle in all about 50 tons of steel per day.

Cost of Steel Plant.

Main foundry building, including drying-ovens, core-ovens, pits, moulds, and a 25-ton overhead crane and runway	$ 60,000
Lean-to building for furnace-house	12,700
Three 6-ton (rated) electric furnaces	75,000
Transformers and electrical equipment for three furnaces	54,000
One 9-inch rolling-mill, including building, one continuous heating-furnace, and three reheating-furnaces	125,000
Total	$326,700

Only two of the electric furnaces would be in operation at any one time, and they would use between them about 3,000 kw., which would bring the total consumption in the whole plant up to about 10,000 kw.

As an alternative to the above, Mr. Dauncey recommends a steel-foundry equipped with two oil-burning open-hearth furnaces, specified as follows:—

Two 15-ton open-hearth oil-fired furnaces; three 15-ton ladles; one overhead 25-ton travelling crane; twenty charging-trucks and boxes; storage oil-tanks and all necessary small equipment for handling 90 tons of steel per twenty-four hours	$145,000
Necessary buildings for the above	35,000
Total	$180,000

This second estimate is for steel-foundry only, without any rolling-mill, but, on the other hand, it has a capacity of 90 tons of steel in place of some 50 tons provided for in the first estimate.

Collecting the figures together, we find for the complete plant:—

7,000-kw. electric-smelting plant for making pig-iron and ferro-alloys	$375,000
3,000-kw. electric steel-foundry and rolling-mills	325,000
Complete iron and steel plant	$700,000

The final daily product of this plant, after allowing for the use of pig-iron and ferro-alloys in the plant itself, would be about:—

	Tons.
Foundry pig-iron	25
Ferro-silicon, ferro-manganese, and ferro-chrome	2
Steel castings and rolled steel	50

APPENDIX X.

THE COST OF MAKING PIG-IRON.

Although the output of foundry iron for sale will be only 25 tons a day, a further 25 or 30 tons of pig-iron will be made for conversion into steel, and additional power will be used for steel-making and the production of ferro-alloys. Instead, therefore, of calculating the cost of producing iron in a plant of 25 tons daily output, using some 3,000-kw., we may fairly figure on a plant of three times this capacity, or 9,000 kw., with a production of 75 tons of foundry iron daily.

The main items of cost in the production of foundry iron are:—

Iron ore of about 55 per cent. costing $4 per net ton.

Charcoal costing $6 to $8 per net ton.

Electric power, labour, and management.

It was understood that electric power could probably be obtained for about $15 per horse-power year, and the following calculations were made on that assumption. It now appears that a charge of 0.5 cent per kilowatt-hour would be made for electric power, and a calculation on this basis is given towards the end of this Appendix.

The cost of labour is discussed in Appendix VII. and in the following pages; it appears to vary from about $4 to $8 per ton of pig-iron, according to the size and nature of the plant, and with the probable variations in wages.

The following discussion is based on the production of foundry pig-iron by the usual electric-smelting methods in furnaces of the Swedish or of the open-pit type in a plant having a total production of 70 or 80 tons daily. The cost of making electric-furnace iron by a method involving the preliminary reduction or metallizing of the crushed ore is discussed in Appendix XII.

COST WITH THE SWEDISH FURNACES.

I have received from Messrs. Electro-Metals, of Sweden, the following estimate of the cost of a ton of pig-iron made in a six-furnace plant of 60,000 tons per year. I quote this unaltered, for interest, as showing the cost at which electric-furnace iron can be made under exceptionally favourable conditions:—

1.5 tons of ore at $1	$ 1 50
0.5 ton of lime at $1	50
0.33 ton of charcoal at $6	2 00
10 lb. of electrodes at 5 cents	50
Electric current at $8 per horse-power year	2 50
Repairs and maintenance	50
Labour	2 00
Management	1 00
Interest and depreciation	1 00
Total cost per ton of pig	$11 50

In this estimate the word "ton" probably denotes in each case the metric ton of 2,204 lb., which is nearly the same as the gross ton of 2,240 lb.

The corresponding figures in British Columbia, in view of the higher costs of ore, power, supplies, and labour, the smaller scale of the plant, the lower grade of the ore, and the production of foundry iron instead of white iron, would be about as follows for 1 gross ton of iron in a plant of three 3,000-kw. furnaces making 27,000 tons of iron per annum:—

2 net tons of ore at $4	$ 8 00
0.4 net ton of charcoal at $8	3 20
15 lb. of electrodes at 8 cents	1 20
0.45 horse-power year at $15	6 75
Repairs and maintenance	1 00
Labour	4 50
Management	2 00
Interest 6 per cent. and depreciation 10 per cent.	2 60
Royalty to Electro-Metals	50
Total	$29 75

It appears that by this system foundry iron can be made at a cost of about $30 per ton.

In regard to these figures it will be noted:—

(1.) That the charge for ore ($8) is high, partly because of the high cost per ton of the ore; this cost could probably be reduced to about $3 per ton of ore if the iron-mining industry should in the future develop on a larger scale. The charge is high, also, because the ore is low grade, containing about 55 per cent. of iron, so that 2 tons of ore are needed to yield 1 ton of pig-iron. If it were possible to obtain a 65-per-cent. ore at $3 per ton, the item of $8 for ore would be reduced to $5.

(2.) I have assumed elsewhere that charcoal could be made from mill-waste at from $6 to $8 per ton. For the open furnace I take the lower figure of $6, but for the Swedish furnace, which requires a better grade of charcoal, I am taking the higher figure. I see no prospect of a material reduction in this item. The amount charged (0.4 ton) is higher than in the previous table, partly on account of the production of foundry iron instead of white iron, and partly because charcoal is weighed by the short ton and pig-iron by the long ton, while the original estimates are doubtless based in each case on the metric ton.

(3.) The electrode-consumption has been increased in view of the production of foundry iron, and the price is that at which electrodes can be imported from Eastern makers. It is possible that by making electrodes locally the cost could be reduced to 4 cents a pound, thus reducing the item from $1.20 to 60 cents per ton of pig-iron.

(4.) The charge of $2.50 for power, estimated by the Electro-Metals Company, corresponds with a consumption of 0.31 horse-power year per ton of iron. This figure must be raised by about 0.05 on account of the lower grade of ore, and a further 0.05 on account of the production of foundry iron, thus making 0.41; 0.45 appears to be as low a figure as it is safe to assume under these conditions.* If in the future power could be obtained at $10 per horse-power year, the item of $6.75 would be reduced to $4.50, effecting a saving of $2.25 per ton.

(5.) The items for labour, management, and maintenance have all been increased from the Electro-Metals estimate in view of the high cost of labour and salaries at the present time. It does not seem likely that any material reduction in these items can be expected during the next five or ten years.

(6.) Interest at 6 per cent. was calculated on the cost of the plant, $400,000, and a working capital of $100,000; and depreciation was calculated at 10 per cent. on the cost of the plant. The output was taken at 27,000 tons per annum. Royalty to the Electro-Metals has been assumed at 50 cents per ton, but I have no grounds for this figure.

(7.) If the economies indicated in (1), (3), and (4) could all be carried out, the cost of making pig-iron would be reduced to about $24 per ton. In view of this, it would appear that a plant making pig-iron in the Swedish furnace with $10 power should be able to continue to operate at a profit even when prices fall considerably below their present level.

The following details of the cost of making electric-furnace iron (probably white pig-iron) at Gellivare, in North Sweden, are contained in a report by J. A. Leffler, which appeared in the *Iron Age*, September 13th, 1917, page 605. I have changed the items from English to Canadian money.

Cost of One (Metric) Ton of (White) Pig-iron.

1.6 (metric) ton of ore (50 per cent. ore and 50 per cent. briquettes) at $2.74	$ 4 38
Limestone	16
0.4 ton of charcoal at $12.50	5 00
0.272 kilowatt-year (0.365 horse-power year at $9.50)	3 46
Electrodes	44
Repair and upkeep	88
Wages	1 56
Management and sundries	54
Royalty	34
Sinking fund	86
Rents	1 38
Carriage to Lulea	1 16
Total	$20 16

Comparing my estimate for present conditions in British Columbia, it will be seen:—

(1.) That we have to face an increase of $3.62 on the cost of ore.

(2.) The consumption of charcoal is taken as the same amount, but we should obtain charcoal more cheaply, thus saving $1.80.

(3.) My power assumption is 0.085 horse-power year more than the above. This is justified by the lower grade of ore used and the higher grade of iron to be made. This difference, together

* A discussion of the power-consumption will be found in Appendix VIII.

with the increased cost per year ($15 instead of $9.50), produces an increase of $3.29 in the charge for power.

(4.) Electrodes cost 76 cents more on account of the greater consumption and the higher price.

(5.) Repairs and maintenance are only 12 cents more.

(6.) Royalty is assumed at 16 cents more.

(7.) Interest and depreciation in my estimate come to 36 cents more than the charges for sinking fund and "rents" in the Swedish estimate.

(8.) Labour and management come to $6.50 in my estimate, but only $2.10 in Sweden. This difference of $4.40 is due partly to the smaller scale of the proposed plant, but mainly to the very much higher scale of wages and salaries now obtaining in British Columbia.

It will be seen that the increased amount of my estimate (about $10 more than the Swedish cost) is due, in about equal proportions, to the increased charges for ore, power, and labour.

MAGNETIC CONCENTRATION OF THE ORE.

It may be worth while to attempt an estimate of the results of concentrating the ore before smelting it, so as to find whether any economy may be expected to result from this operation.

Assume the ore is a magnetite containing 50 per cent. of iron and costing $3 a ton at the concentrating plant, with a further charge of $1 per ton freight to the smelter. The cost, using the undressed ore, is $8.80 per ton of pig-iron, as 2.2 net tons of ore would be needed. The ore is crushed to a coarse powder at a cost of 50 cents a ton. One ton of the crushed ore will probably yield 0.6 ton of 70-per-cent. concentrate and 0.4 ton of 20-per-cent. tailings. The concentrate is sintered with cheap fuel on the Dwight-Lloyd machine and the briquettes shipped to the smelter. The cost of dressing and sintering will be about $1 per ton of the concentrate. The cost of the product per ton of pig-iron will be:—

2.4 tons of ore mined at $3	$ 7 20
2.4 tons of ore crushed at 50 cents	1 20
1.4 tons of concentrates, dressing and sintering at $1	1 40
1.4 tons of concentrates, freight at $1	1 40
	$11 20
2.2 tons of 50-per-cent. ore at $4	8 80
Increased cost due to process	$ 2 40

On the other side we may expect the following economies:—

2½ lb. of electrodes at 8 cents	$ 20
0.08 horse-power year at $15	1 20
Repairs and maintenance	15
Labour	65
Management	30
Interest and depreciation	40
Total	$ 2 90

It does not appear, therefore, that a great saving could be effected by dressing a 50-per-cent. ore if crushing and sintering were necessary, though Messrs. Beckman and Linden consider that a net saving of nearly $3 per ton could be effected in this way. I may add that for this calculation I have assumed that the operation of sintering would remove the sulphur so completely that it would not be necessary to form a slag for its removal, and also that a white iron would be made and turned to foundry iron by the addition of ferro-silicon, so that it would not be essential to have any silica in the furnace charge. An alternative plan would be to use about two-thirds of sintered concentrates and one-third of undressed ore in the furnace charge, thus obtaining enough silica for the production of foundry iron.

Although the above calculation shows only a small saving by the concentration of a 50-per-cent. iron ore, it is possible that a more important economy could be effected by magnetic concentration in the manner indicated in Appendix III.

PRODUCTION OF FOUNDRY IRON.

On account of the fact that the Swedish furnace is generally used for the production of a white pig-iron containing not more than about 1 per cent. of silicon, we have no exact data for the production of foundry iron of, say, 3 per cent. of silicon in this furnace. We are satisfied, however, that there would be a decided increase on this account in the cost for power, charcoal, electrodes, and maintenance, besides the general overhead, labour, and interest charges. In view of this, it is worth while to consider what the cost would be of converting white iron into foundry iron by the addition of ferro-silicon. One ton of iron containing 1 per cent. of silicon would need the addition of 0.04 ton of 50-per-cent. ferro-silicon to raise its silicon content to 3 per cent. This ferro-silicon would cost, made in the plant, about $85 per ton, or $3.50 for the amount needed.

If the pig-iron were received in a large ladle and the ferro were thrown in red-hot, there should be enough heat to effect a perfect mixture; and as the iron is cast into pigs for sale, and then remelted in a cupola, any irregularity would be remedied before the final casting. The saving in the cost of smelting through producing white iron instead of foundry iron would about equal the cost of the ferro-silicon, and there would be the added advantage of making a single furnace product and turning as much of this as was needed into foundry iron.

Mr. Gronwall, in his estimate made in 1914, places the difference in cost between grey and white pig-iron as:—

0.03 ton of charcoal.
0.03 horse-power year.
5 lb. of electrodes.
10 cents for repairs.
7 cents for petty charges.

Under our conditions this would mean:—

Charcoal at $8	$0 24
Power at $15	45
Electrodes at 8 cents	40
Repairs and petty charges	21
Total	$1 30

We must add, however, a proportion of the charges for labour, management, and fixed charges amounting to about 60 cents, thus bringing the whole up to $1.90. The additional expense may easily be as much as 0.05 ton of charcoal and 0.05 horse-power year, and the increased cost would then be about $3 a ton (everything considered), or nearly as much as the cost of the ferro-silicon addition.

The ferro-silicon used was found to cost $3.50, but, as it replaces an equal weight of pig-iron costing $1, the net cost of the addition will only be $2.50 per ton of the resulting foundry iron.

The foregoing discussion is not intended to prove that the addition of ferro-silicon to white iron is the best way of making foundry iron, but merely that the use of the Swedish furnace for foundry iron would be perfectly safe, because ferro-silicon could be added without much additional expense if it were found impracticable to make foundry iron directly.

COST OF SMELTING IN SIMPLE PIT FURNACE.

The following is an estimate of the cost of making a ton of foundry iron in a 3,000-kw. furnace of the simple pit type. This estimate has been prepared by Messrs. Beckman and Linden, depending on their commercial experience of the production of ferro-manganese in such a furnace. As, however, they have no data with regard to the production of pig-iron, they have accepted my figures for the probable consumption of power and charcoal in such a furnace. These assumptions, which are based on calculation, are that the open furnace would need 0.50 horse-power year of electric power, which is 0.05 more than I allowed for the Swedish furnace, and 0.50 ton of charcoal, which is 0.1 ton more than I allowed for the Swedish furnace.

Messrs. Beckman and Linden argued, from general considerations, that the open furnace would be at least as economical of power as the Swedish furnace, but were not prepared to guarantee such a performance. I do not think it will be safe to assume any better figures than those I have given until the performance of this furnace has been demonstrated in commercial

operation over a considerable period. The figures they give for labour, general expenses, and interest are probably too high, because they are considering a single 3,000-kw. furnace, while the plant we have in view will employ about 10,000 kw. The output of the single furnace is taken as 8,000 tons per annum.

*Beckman and Linden's Estimate of the Cost of One Long Ton of Foundry Pig-iron made in Open Furnace from a 50-per-cent. Ore.**

Iron ore, 2 tons at $4 per ton	$ 8 00
Electrical power, 0.5 horse-power year at $15	7 50
Charcoal, 0.5 ton at $6 per ton	3 00
Electrodes, 20 lb. at 10 cents per pound	2 00
Labour	8 00
Supplies	1 00
Plant and general office expenses	5 00
Interest and depreciation, 20 per cent. on $180,000	4 50
Total	$39 00

If we are considering this furnace as a unit in a plant of 10,000 kw., it seems probable that the cost of labour would be about $6, the general expenses $3, and the interest and depreciation $3. With these changes the total cost would be reduced to $33.50, or about $4 more than my estimate with the Swedish furnace.

Messrs. Beckman and Linden consider that using 50-per-cent. ore at $4 they could obtain a 65-per-cent. concentrate at $6.45 per ton, including the cost for concentrating and sintering of $1.25 per ton of concentrate. Using this concentrate, they estimate the following, assuming an output of 10,000 tons per annum from a 3,000-kw. furnace:—

Beckman and Linden's Estimate of the Cost of Foundry Iron from 65-per-cent. Concentrate.

Iron ore, 1.54 tons at $6.45 per ton	$ 9 93
Electric power, 0.4 horse-power year at $15	6 00
Charcoal, 0.5 ton at $6	3 00
Electrodes, 20 lb. at 10 cents per pound	2 00
Labour	6 40
Supplies	1 00
Plant and general office expenses	5 00
Interest and depreciation, 20 per cent. on $140,500	2 81
Total	$36 14

This estimate shows a saving of $3 as compared with the cost of smelting the undressed ore, but I am doubtful whether so small a degree of concentration would do more than barely pay for itself. Thus, even assuming the small cost of $1.25 per ton of concentrate to cover the crushing of the ore, the magnetic dressing, and the sintering of the concentrate, it appears that Messrs. Beckman and Linden have figured on a perfect dressing, losing no iron in the tailings. If we assume the latter to contain even so little as 15 per cent. of iron, we would need 1.43 tons of ore for each ton of concentrate, which with the above charge would work out at $6.97 per ton, or $10.30 per ton of iron. The difference in power-consumption of 0.10 horse-power year per ton was deduced from my own figures, but is probably rather too high; 0.075 would be a more probable estimate. A mistake appears to have been made in the item for interest and depreciation, which can hardly be reduced from $4.50 to $2.81 by the increased richness of the ore. I believe it would be found in practice that the enrichment of the ore from 50 to 65 per cent. would not effect any considerable saving. On the other hand, as I show elsewhere, if an ore of, say, 40-per-cent. could be mined decidedly more cheaply per unit of iron contents than a 50-per-cent. ore, a concentrate of 65 per cent. or upwards could probably be made from this cheaper ore at such a price as to offer a material saving. It should be added that the whole of the foregoing discussion depends upon the ease and completeness with which the ores of British Columbia can be concentrated. At present we have no information on this subject.

* It will be found that, making reasonable allowance for losses, the ore would have to contain about 55 per cent. of iron in order that 2 net tons of it should yield 1 long ton of pig-iron.

An examination of the above estimate will show that the consumption of iron ore must be taken as 2 *long* tons of 50-per-cent. ore and 1.54 *long* tons of 65-per-cent. concentrate respectively per long ton of pig-iron produced. They differ in this respect from my own estimates, which are in *short* tons of ore per *long* ton of pig-iron. My estimates were made in that way because the cost of ore, charcoal, etc., in British Columbia is quoted on the short ton, while pig-iron is always sold by the long ton.

For the purpose of this report, I furnished Messrs. Beckman and Linden with the following estimate of the commercial consumption of power and charcoal per long ton of foundry pig-iron made in an open-pit furnace. This estimate may be regarded as too conservative, but I have no data on which I could base a closer estimate.

	H.P. Year.	Net Ton Charcoal.
White charcoal iron from 65-per-cent. concentrate	0.35	0.45
White charcoal iron from 50-per-cent. iron ore	0.45	0.45
Grey charcoal iron from 65-per-cent. concentrate	0.40	0.50
Grey charcoal iron from 50-per-cent. iron ore	0.50	0.50

I have no reason for doubting the general correctness of these figures, which, of course, will vary with the size of furnace and operating conditions, but for purposes of comparison I would alter the power-consumption assigned to items 2 and 3 so as to make them equal. Thus the power-consumption for white charcoal iron from 50-per-cent. ore and for grey charcoal iron from 65-per-cent. concentrate would each be 0.42 or 0.43 horse-power year.

Comparison with Blast-furnace Methods.

It may be of value to compare with my estimate of the cost of making pig-iron in the Swedish furnace the following estimates by the B. L. Thane Company of the cost of making pig-iron in a large blast-furnace near Puget sound at 1918 prices:—

B. L. Thane Company's Estimate of the Cost per Long Ton of Blast-furnace Pig-iron.

Iron ore, 3,457 lb. at $4.40 per long ton	$ 6 81
Coke, 2,485 lb. at $9.60 per net ton	11 93
Limestone, 1,000 lb. at $1.90 per long ton	81
Labour	1 50
Materials	1 50
Capital charges	3 40
Total	$25 95

(1.) The charge for iron ore, $6.81, is less than my estimate of $8, merely because the ore is assumed to contain 65 per cent. of iron, whereas I have been advised that it will not be safe to assume more than 55 per cent.; the price per ton of ore being the same ($4.40 per long ton instead of $4 per short ton).

(2.) The charge for coke, $11.93, is more than the combined charges for charcoal, electrodes, and power, $11.15.

(3.) The capital charges are nearly the same, $3.40 and $2.50, or including the royalty, $3.10.

(4.) The electric-furnace estimate is higher than the other on account of the heavy charges for labour, $4.50, and management $2, compared with the single item of $1.50 for labour in the blast-furnace plant. This difference is caused mainly by the difference in the scale of operations; a coke blast-furnace turning out at least 300 tons of iron daily, while the electric furnace would scarcely make 30 tons.

In conclusion, there does not appear to be any cause, other than the different size of the furnaces, why electric-furnace iron should cost more than blast-furnace iron under the conditions we find on the Coast, and providing that power can be obtained at $15 or less.

Two other estimates by the B. L. Thane Company place the consumption of coke at 2,240 lb., costing $7.13 per net ton of coke or $7.98 per ton of iron, and at 2,625 lb., costing $12.20 per net ton of coke or $16 per ton of iron; the total cost of a ton of pig-iron coming to $22 and $30.02 respectively.

Since the above was written I have received a letter from the British Columbia Electric Railway Company, which is reproduced in Appendix IV., stating in effect that they would supply large blocks of power up to 10,000 horse-power in the neighbourhood of Vancouver for a charge

of 0.5 cent per kilowatt-hour. This charge is so high as to render impossible any large-scale production of electric pig-iron in the Swedish or open-pit furnace, and unless some other method can be devised that will need decidedly less power, all that can be done will be to make a small amount of pig-iron during the present period of extreme high prices. In view of the necessarily temporary nature of such operation, it would be impossible to install a plant of Swedish furnaces, and we can only consider the simple open-pit furnace, because, although it uses more power per ton of pig-iron, it can be installed more quickly and more cheaply, and can easily be converted to the production of ferro-alloys, or even replaced by electric steel-making furnaces, when the drop in the price of pig-iron shall render its production impossible.

In calculating the cost of making iron in the simple pit furnace with power at 0.5 cent, I must, for comparison with the previous instances, convert this figure into a charge for the horse-power year. For this purpose I shall assume a load factor of 85 per cent., which provides for stops for repairs, as well as the usual degree of irregularity of power. On this assumption the horse-power year would cost $27.80. The cost of making a long ton of foundry iron in a plant of 10,000 kw. would be about as follows:—

Cost of One Long Ton of Foundry Iron using 0.5-cent Power.

Iron ore, 2 tons at $4 per ton	$ 8 00
Electrical power, 0.5 horse-power year at $27.80	13 90
Charcoal, 0.5 ton at $6 per ton	3 00
Electrodes, 20 lb. at 10 cents per pound	2 00
Labour	6 00
Supplies	1 00
Plant and general office expenses	5 00
Interest and depreciation	3 00
Total	$41 90

With so high a charge for power the operations would probably be on a smaller scale, and it would be inexpedient to install as much labour-saving appliances, so that the cost would agree more closely with Beckman and Linden's estimate of $39, corrected for the higher price of power. This would come to $45.40 per ton of pig-iron. Thus it appears that unless cheaper power can be obtained the cost of making electric pig-iron in British Columbia will be in the order of $40 to $45 per ton.

The British Columbia Railway Company offer 2,000 kw. of $15 power on Vancouver island, but this does not improve the situation materially, because the scale of operations would be so small that the cost of a ton of iron would certainly be in excess of $40.

It should also be noted that the above offers of power carry some restrictions with regard to the company's peak-load periods. I have no particulars in regard to this, but no doubt it would further increase the operating cost by reducing the output from a given electrical plant and staff.

APPENDIX XI.

REPORT BY MESSRS. BECKMAN AND LINDEN.

Introductory Note by Dr. Stansfield.

When undertaking the present investigation I considered that it was very important to decide whether the high Swedish furnace or the simpler pit furnace used at Heroult would be the more suitable under the conditions existing in British Columbia.

I was familiar with the Swedish furnaces, but not with the Californian furnace, and I therefore visited San Francisco and Heroult. At San Francisco I met Messrs. Beckman and Linden, an engineering firm who have specialized in electric smelting and had recently erected a plant

for the production of ferro-alloys at Bay Point. Mr. Beckman is familiar with conditions in Sweden as well as in California, and I therefore discussed with him the design of furnace and plant for the production of pig-iron. In spite of his knowledge of the Swedish type of electric furnace, Mr. Beckman concluded that a simple pit furnace of the kind used for making ferro-alloys would, on the whole, be better than the Swedish furnace for the conditions in British Columbia. Such a furnace is substantially the same as the furnace that has been used at Heroult, with the exception of the roof and charging-chutes. In view of Mr. Beckman's knowledge of Sweden and California and of his experience in designing, erecting, and operating the plant at Bay Point, I asked him to prepare a design for an electric-smelting plant in British Columbia. The general outline of the plant was arranged between us, and I furnished him with the necessary data in regard to the nature and cost of the ore, charcoal, power, and labour. I understood that he would give an estimate for the consumption of power and charcoal per ton of pig-iron, but Mr. Beckman finally decided to take my figures for these items as the basis for his report.

I had in mind at that time a plant which would contain:—

Three 3,000-kw. furnaces for smelting ore.
Three 300-kw. furnaces for smelting ferro-alloys.
Two 1,500-kw. furnaces for making steel.

At first, however, the building was to be large enough for two 3,000-kw. and three 300-kw. furnaces; and only one of the 3,000-kw. furnaces, together with the three 300-kw. furnaces, were at first to be installed. Unfortunately, Mr. Beckman based his design of the plant and his estimate of the cost of making iron on the smallest equipment considered, which was only intended to be temporary, and on this account his estimate of the cost per ton of making pig-iron is higher than necessary.

ELECTRIC PIG-IRON IN BRITISH COLUMBIA.

REPORT BY BECKMAN AND LINDEN ENGINEERING CORPORATION, SAN FRANCISCO, JULY, 1918.

GENERAL REMARKS.

The following report is made at the request of, and is based upon figures which have been supplied by, Dr. Alfred Stansfield, of McGill University, Montreal, and has reference to a possible pig-iron industry in British Columbia. All of the conclusions reached are based upon and deduced from information received in this manner.

LOCATION OF PLANT.

In British Columbia there is available a considerable amount of developed hydro-electric power and also a large amount of power which is awaiting development. It would be considered advisable in connection with this investigation to locate the proposed pig-iron plant at a place where already developed power is available, and in such locality that the raw materials essential in this industry are obtainable with the least effort. We may take, for example, such a point as Port Moody, approximately ten miles distant from Vancouver. This community has access to the Canadian Pacific Railway and also deep-water facilities. The British Columbia Electric Railway Company, Limited, have transmission-lines already in Port Moody. Port Moody has a small electric furnace operating for the manufacture of other products, which would facilitate the obtaining of labour to some extent for the undertaking along the lines suggested.

GENERAL OUTLINE OF PROJECT.

It is a well-known fact that in Sweden great quantities of pig-iron are manufactured by means of reducing iron ore in electric furnaces, utilizing charcoal as reducing agent. The conditions existing in Sweden and those existing in British Columbia are very similar. It therefore suggests itself that the manufacture of pig-iron in British Columbia should offer opportunities similar to those in Sweden. The project here would be based on four units. The first to be installed would consist of one 3,000-kw. furnace and possibly three 300-kw. single-phase furnaces; the former furnace for the purpose of manufacturing pig-iron, and the latter furnaces for the purpose of manufacturing ferro-alloys, such as ferro-molybdenum, ferro-chrome, ferro-tungsten, and others. The next step would be the addition of a 5,000-kw. furnace for the manufacture of pig-iron, or it might be thought more advisable to put in a 10,000-kw. furnace for this purpose. The difference in operation and equipment between a 3,000-kw. and a 5,000-kw.

furnace is not very material and would only involve an increase in production, while the operation and equipment of a 10,000-kw. furnace would be materially different and a distinct development over a 3,000-kw. furnace. Of course, the investment on a 10,000-kw. furnace would be considerably greater than on a 5,000-kw. furnace, and on that account it might be considered advisable to take an intermediary step. The furnaces would be built in such a manner that they could easily be adapted to manufacturing other alloys, such as ferro-silicon. The purpose of this would be to make the plant as flexible as possible, so that in case the price of pig-iron went down the plant could be used economically for other purposes.

Raw Materials.

In the manufacture of pig-iron the essential raw materials are:—

A. Cheap electric power.
B. Iron ore.
C. Reducing agent, such as charcoal.
D. Fluxing agent.
E. Electrodes.

A. Hydro-electric Power.—The amount of power necessary to produce 1 ton of pig-iron in the electric furnace is dependent to a great extent upon the purity of the ores. The iron ore which is available for this undertaking would consume approximately 0.5 horse-power per year per ton of pig-iron. In case the ore was concentrated up to 65 per cent. iron content, it would take 0.4 horse-power per year per ton of pig-iron. It is apparent from the following cost data that the power cost is one of the large items, and to make such an undertaking successful it is essential that low power prices are obtainable. It is understood that the British Columbia Electric Railway Company, Limited, has available 10,000 horse-power, 60-cycle power, that could be put into service immediately. Later developments of this industry would necessitate the development of new hydro-electric power sites in close proximity to raw materials.

B. Iron Ore.—The raw material on which the whole industry is based is the iron ore. There are a number of iron-ore deposits in British Columbia on the mainland, as well as on the islands, and it would be a question of its availability to Port Moody which would partially govern as to its use in this undertaking. The ore which has been suggested is a magnetite ore containing lime of an average analysis of:—

	Per Cent.
Iron	50 to 55 (Fe_3O_4 69-76%).
Silica	5 to 6
Alumina	4
Phosphorus	0.02
Sulphur	0.1
Calcium carbonate, etc.	15 to 21

The ore is claimed to be practically self-fluxing and would on that account not necessitate the use of any fluxing agent whatsoever. In a general way this ore is low in its iron content for a very successful pig-iron operation. If there were some ore of higher grade available and at a low price, it would be strongly advisable to consider these deposits in preference to the iron ore under discussion. There is, though, a means by which this ore could be brought up to a higher degree of purity, which would involve a concentrating plant and the sintering of the obtained concentrates. This would, of course, increase the cost of the ore and would give a higher iron content of ore material to work with, which would increase the output per horse-power year in the electric furnace. It would therefore appear that, if no other ore is available, a concentrating plant would be advisable.

C. Reducing Agent.—In the Swedish practice where electric pig-iron is produced charcoal is used as a reducing agent. This is obtained as a by-product from the large lumber and timber operations in Sweden, where pine, spruce, and fir are handled, and there is no timber operation in Sweden of any kind where the refuse is not turned into charcoal either in a by-product charcoal-oven or by pit-charcoaling. British Columbia, as we understand it, has large timber operations, as well as large stands of timber, that in many cases are worthless for timber purposes. These waste lands might be gone over and the timber turned into charcoal, as well as by-products, such as alcohol, acetic acid, creosote-oil, and also turpentine. The creosote-oils are used extensively in flotation purposes where the metal values are separated from the gangue. Charcoal obtained in such a manner, either in by-product coke-ovens or in pit-charcoaling, contains approximately 73 per cent. fixed carbon.

British Columbia holds in its bituminous-coal deposits another reducing agent that under special conditions may be used to advantage. It is high in ash and reported to contain 50 per cent. fixed carbon.

It has also been suggested as a possibility to utilize some of the oil-wastes obtainable on the Pacific coast as a reducing agent in making pig-iron. This material contains practically no ash and about 70 per cent. of fixed carbon.

D. Fluxing Agent.—As has been explained under the heading "Iron Ores," the iron ore proposed to be used in this undertaking would not need any fluxing material. Limestone, though, as a rule is used for this purpose, and is available at various points accessible to Port Moody in a purity suitable for this operation.

E. Electrodes.—All electric-furnace operations for the reduction of ores are dependent on the supply of electrodes. Electrodes are the means by which the electric current is made available in the furnace. There are plants on the Pacific coast which are manufacturing electrodes, and there are large manufacturers of electrodes in the East, both in Canada and the United States. It would seem as though an undertaking of this kind in British Columbia should depend upon its electrode-supply from a Pacific Coast source, and it would be advisable to make an early arrangement with the manufacturers there for this essential.

General Plant Layout.

The plant would be composed of the main furnace building, adjacent to which would be the transformer building. The furnace building would give ample space for the furnace and the necessary electrical connections, as well as the casting-floor on to which the pig-iron would be tapped. This building would have a big electric travelling crane and also the necessary tracks for the purpose of moving raw materials about and moving the finished products. The initial size of the building would be one which could house a 3,000-kw. furnace and three 300-kw. single-phase furnaces. Buildings, such as storehouse, laboratory, office, wash-house, etc., would be placed at convenient points on the ground. The necessary trackage would have to be laid out in the yards for the handling of all materials and incoming and outgoing shipments. Ample storage-space would be necessary in the yards for the storing of raw materials. There should be approximately sixty days' supply of iron ore in stock, amounting to approximately 4,000 tons. Storage-space should also be provided for a large tonnage of charcoal. The amount that would have to be kept in storage would depend upon the physical conditions surrounding the plant and the accessibility to the charcoal-producing installations. It would be advisable to plan for the necessary roof-sheds to cover two to three months' supply of charcoal. In case any fluxing agent should be needed, space should be provided for the storage of same. Electrodes could be stored in suitable numbers in a small building. To handle efficiently the raw materials and finished product from stock-piles to dump-cars, etc., a locomotive crane would be needed.

Type of Furnace.

The type of electric furnace in which pig-iron is made in Sweden has a close resemblance to the shaft-furnace. The shaft carrying the burden is supported by braces, and the reduction takes place in a big bowl at the bottom of the shaft, into which the electrode projects. There is a heavy strain on the structure in general, and the refractory roof of the furnace itself receives very severe treatment and frequently needs rebuilding. It has been carefully considered in this connection that it would be advisable to try out a simpler furnace very similar to those used in the manufacture of ferro-silicon and ferro-manganese—a simple 3-phase open-pit furnace. By installing this kind of a furnace and holding the Swedish shaft-furnace in reserve, if the tests work out as anticipated, a saving in installation will take place and a step forward will have been made in the manufacture of pig-iron. It is expected to produce in such a furnace grey pig-iron containing 3 to 4 per cent. carbon, 2 to 3 per cent. silicon, 0.05 per cent. sulphur, and 0.5 per cent. phosphorus. If the results do not come up to expectations, the furnace can readily be adapted to manufacturing ferro-silicon or ferro-manganese and a duplication of the Swedish furnace can be installed. The Swedish shaft-furnaces are beyond the experimental stage, working successfully day in and day out in manufacturing white pig-iron. Some trouble has been encountered in manufacturing grey pig-iron in these furnaces. The white pig-iron, though, is used very successfully in open-hearth furnaces and in electric steel manufacture.

COST OF PLANT.*

(At 1918 Prices of Apparatus and Construction.)

One 3,000-kw. 3-phase furnace, installed, including casing, electrode-holders, jib-cranes, regulators, and foundations	$ 15,000
Four 1,000-kw. single-phase, 33,000-volt primary, 60-cycle oil-insulated and water-cooled transformers, installed, with from 60 to 120 volts in 5-volt steps on the secondary side (one of these transformers is spare)	26,000
One set low-tension busses for 3,000-kw. furnace, installed	5,000
One set high-tension busses for 3,000-kw. furnace, including oil-switches, switchboard, and meters	6,000
Three 300-kw. single-phase furnaces, installed, including casing, electrode-holders, and regulating device	10,000
Four 300-kw. 33,000-volt primary, 60-cycle, single-phase, oil-insulated and water-cooled transformers, installed, with a range of from 70 to 100 volts in 5-volt steps on the secondary side	10,000
Three 50-kw. single-phase, 60-cycle, 33,000 volts to 440 volts air-cooled transformers, installed, with switchboard (to be used for industrial purposes around plant)	2,000
One 25-kw. motor-generator set for regulators, etc., installed	2,000
Three sets low-tension busses for 300-kw. furnaces	1,500
One furnace building, built entirely of reinforced concrete, including electric travelling crane, tracks, metal-handling equipment, etc.	35,000
One transformer building, built entirely of reinforced concrete	10,000
One shipping-store building of wood and stucco exterior finish	7,000
One laboratory with complete equipment	7,500
One store-room and change-room building, built of wood and exterior stucco finish, including steel lockers, toilets, wash-basins, and shower-baths	8,000
One machine-shop with equipment	10,000
One office building	3,000
One gate-house with time-clock and time-keeper's office	500
Railroad tracks, industrial track, ore-handling equipment, water-supply, sewerage, fence, and industrial lighting, etc.	25,000
Land, 4 acres	4,000
	$187,500
Engineering and contingencies, 20 per cent.	37,500
Total	$225,000

It is well to point out that the above figures cover the cost of a plant that is built entirely of permanent construction. Permanent-construction figures in the first cost are higher than any temporary work, of course; but due to the great fire risk of temporary work, such as wooden construction, it is deemed more advisable to make the larger initial investment to cut down the maintenance cost of a temporary plant.

The electrical equipment selected and put into this estimate is such that, according to our experience with identical design and equipment, a power factor can be obtained on the power company's line as high as from 90 to 92 per cent.

COST OF PRODUCTION.

Two sets of figures have been made out on the cost of production of pig-iron. The pig-iron which is supposed to be produced is grey foundry pig-iron, and would have a market value of $35 per ton at the plant. The figures which have been worked out are based on crude ore and concentrated ore, assuming that the crude ore would be obtained in one case for $4 per ton, and in the other case increased to $6.45 per ton by concentration. Another set of figures is based

* In this cost estimate is not included ore-concentrating and sintering plant, nor charcoal plant.

on price of crude ore at $1.50 per ton, and concentrated ore at $3.20 per ton. This includes the cost of concentrating and sintering, amounting to $1.25 per ton concentrate. The power is assumed to be delivered at the switchboard at $15 per horse-power year. The reducing agent—charcoal—is assumed to be obtained at a price of $6 per ton ($6 per ton being the price for British Columbia coal), and $7 per ton the price of oil-waste carbon. In the following figures charcoal only has been taken into consideration, though the amounts of the different reducing agents needed to reduce 1 ton of 55-per-cent. ore are as follows:—

	Ton.
Charcoal containing 73 per cent. fixed carbon	0.5
British Columbia coal, 50 per cent. fixed carbon	0.8
Oil-waste carbon, 70 per cent. fixed carbon	0.6

In producing from an ore containing 55 per cent. iron, 2 tons per horse-power year is estimated as a safe figure upon which to base calculations. On ore containing 65 per cent. iron, 2.5 tons per horse-power year production is assumed a safe figure upon which to base calculations. It is evident from the above that operating with a 55-per-cent. ore in a 3,000-kw. furnace would give an annual production of 8,000 tons of pig-iron, while the annual production obtained in a 3,000-kw. furnace with concentrated ore would be 10,000 tons of pig-iron. The operation of the furnace would be continuous twenty-four hours' operation and would be operated in three shifts. The costs would be as follows:—

$4 per Ton Crude Ore (50 Per Cent. Iron).

Electric power, 0.5 h.-p. year at $15 per h.-p. year	$7 50
Iron ore, 2 tons at $4 per ton	8 00
Coal, ½ ton charcoal at $6	3 00
Electrodes, 20 lb. per ton of metal produced at 10 cents a pound	2 00
Labour	8 00
Supplies	1 00
Plant and office general expense	5 00
Interest on investment and depreciation, 20 per cent.	4 50
Total	$39 00

Total Production, 8,000 Tons Pig-iron.

Gross earnings at $35 per ton	$280,000
Cost to manufacture at $39	312,000
Deficit	$32,000

Crude Ore at $1.50

Electric power, 0.5 h.-p. year at $15 per h.-p. year	$7 50
Iron ore, 2 tons at $1.50 per ton	3 00
Coal, ½ ton charcoal at $6	3 00
Electrodes, 20 lb. per ton of metal produced at 10 cents a pound	2 00
Labour	8 00
Supplies	1 00
Plant and office general expense	5 00
Interest on investment and depreciation, 20 per cent.	4 50
Total	$34 00

Total Production, 8,000 Tons Pig-iron.

Gross earnings at $35 per ton	$280,000
Cost to manufacture at $34	272,000
Net profit	$8,000

$6.45 per Ton Concentrated Ore (65 Per Cent. Iron).

Electric power, 0.4 h.-p. year at $15 per h.-p. year	$6 00
Iron ore, 1.54 tons at $6.45 per ton	9 93
Coal, ½ ton charcoal at $6	3 00
Electrodes, 20 lb. per ton of metal produced at 10 cents a pound	2 00
Labour	6 40
Supplies	1 00
Plant and office general expense	5 00
Interest on investment and depreciation	2 81
Total	$36 14

Total Production, 10,000 Tons Pig-iron.

Gross earnings at $35 per ton	$350,000
Cost to manufacture at $36.14	361,400
Deficit	$11,400

Concentrated Ore at $3.20

Electric power, 0.4 h.-p. year at $15 per h.-p. year	$6 00
Iron ore, 1.54 tons at $3.20 per ton	4 93
Coal, ½ ton charcoal at $6	3 00
Electrodes, 20 lb. per ton of metal produced at 10 cents a pound	2 00
Labour	6 40
Supplies	1 00
Plant and office general expense	5 00
Interest on investment and depreciation, 20 per cent.	2 81
Total	$31 14

Total Production, 10,000 Tons Pig-iron.

Gross earnings at $35 per ton	$350,000
Cost to manufacture at $31.14	311,400
Net profit	$36,600

It is from these figures very apparent that it would be impossible to go into the pig-iron manufacture using unconcentrated ores; while operating with concentrated ores at $3.20 shows a reasonable return.

Electric Steel-furnace.

It would seem as a logical arrangement in connection with the pig-iron furnace to establish an electric steel-furnace, in which special steel will be manufactured. There is no possibility at the present time for an iron industry on the Pacific coast to compete with Eastern production of heavy steel material. There is a field here legitimate and profitable to manufacture special shapes of light rolled metal, as well as steel castings. With all the mining industries going on in the West and with the ship-building industries growing out here at a pace, there is an urgent need for special alloy steel and special electric steel castings. The raw materials for the alloy steel are available on the Pacific coast and could be readily smelted and put into steel products. The material which comes out of the pig-iron furnace would be carried in a ladle in a molten condition to the steel-furnace, and in such a manner cut down the melting cost and refining cost of the finished steel product. It is certain that better financial success would be made by installing an electric steel-furnace in conjunction with the pig-iron manufacture and a rolling-mill than by operating the plant exclusively on pig-iron.

Ferro-alloy Furnaces.

The three 300-kw. furnaces can be used for the manufacture of alloys which could easily be used in the production of steel. The operation of these furnaces could be carried on easily in conjunction with the large 3,000-kw. furnace.

Conclusions.

The foregoing report shows the following:—

(1.) That conditions in British Columbia lend themselves well to the manufacture of pig-iron under special conditions.

(2.) That the successful manufacture of pig-iron in British Columbia is dependent upon a low-priced iron ore.

(3.) That British Columbia holds by virtue of its large supply of timber and its deposits of bituminous coal two reducing agents suitable for the manufacture of pig-iron.

(4.) That cheap hydro-electric power delivered at a figure not higher than $15 per horse-power year is essential.

(5.) That the concentrating and sintering of concentrates before the ore is used in the furnace is essential in the manufacture of pig-iron from British Columbia ore.

(6.) That a steel industry in conjunction with the pig-iron furnace and alloy-furnaces is a more advantageous undertaking than a pig-iron industry exclusively.

Beckman & Linden Engineering Corporation.

(Signed.) J. W. Beckman, *President.*

Cost of manufacturing Ferro-silicon.

(Appendix to Beckman & Linden's Report.)

In the foregoing report reference is made to the possibility of utilizing the furnace suggested there for the manufacture of ferro-silicon. The following figures would indicate the cost of producing 1 ton of metal and the returns which would be obtained:—

Power at $15 per horse-power year	$15 00
Quartz, 2,400 lb. at $3.60 per ton	4 20
Coal, 1,210 lb. at $6 per ton	3 63
Turnings, 1,500 lb. at $10 per ton	7 50
Electrodes, 60 lb. per ton of metal at 10 cents per pound	6 00
Labour	16 00
Supplies	1 00
Plant and office general expense	5 00
Interest on investment and depreciation, 20 per cent.	9 38
Total	$67 71

The total output of this plant would be about 4,000 tons of 50-per-cent. ferro-silicon per year, and, assuming that 50-per-cent. ferro-silicon sold for $150 per ton, the net profit would be:—

Gross earnings at $150 per ton	$600,000
Cost to manufacture at $67.71 per ton	270,840
Net profit	$329,160

APPENDIX XII.

A NEW METHOD OF PRODUCING ELECTRIC-FURNACE IRON.

The operation of smelting an ore of iron for pig-iron includes two distinct steps, which are, however, carried out in the same furnace and to some extent simultaneously.

The first step is one of reduction, in which the ore, consisting largely of oxide of iron, is converted into metallic iron by means of carbon or carbonaceous gases. The second step is one of fusion, in which the metallic iron, already formed, is melted and becomes pig-iron. The gangue of the ore, together with the flux, is also melted and forms slag.* The first step can be carried out at a moderate temperature of, say, 700° or 800° C., while the second step needs a very high temperature, say, 1,400° or 1,500° C. Although the first step can be effected at a lower temperature than the second, it consumes about twice as much heat, measured in calories or kilowatt-hours, and it is this large requirement of heat that renders so costly the electric smelting of iron ores. That this is practically true will be made clear when I mention that a ton of steel can be melted in an electric furnace by means of 600 or 700 kilowatt-hours, whereas about 2,500 kilowatt-hours are needed to produce a ton of pig-iron from the ore.

In the electric furnace both steps of the smelting operation are carried out more or less simultaneously, and at a high temperature; and this causes waste of heat and unnecessary expense, particularly as the heat is derived from costly electrical energy. The smelting operation produces a large amount of hot carbonaceous gases, which in a simple electric furnace escape and burn above the charge. These gases may be utilized for heating and reducing the ore, and the Swedish furnace is provided with a large shaft for this purpose. A careful analysis shows, however, that the most efficient furnace of this type is decidedly inefficient from an economic point of view; and we are led to consider whether better results can be obtained in some other way.

I have thought, for a long time, that greater economy could be obtained by separating the two stages of the smelting process and carrying them out in separate furnaces. The ore, crushed to a coarse powder, would be reduced to the metallic condition by means of carbon in one furnace using fuel-heat, and the metallic powder would then be melted electrically. It appears that in this way a pig-iron of electric-furnace quality could be obtained more cheaply than by direct electric smelting.

Until recently I had no experimental evidence in regard to the preliminary reduction of the ore, and had intended to undertake a series of experiments for this purpose; but during the last few months I have obtained information with regard to this point, which makes it seem probable that the process can be carried out practically, and that a decided economy will be gained by its use.

The possibilities of the process will be made clear by the following numerical discussion:—

The reduction of magnetite by carbon will probably follow the equation: $Fe_3O_4 + 3C = 3\ Fe + 2\ CO + CO_2$. This requires 115,000 calories for the reduction of 1 kilogram molecular weight of magnetite, or 686 calories per kilogram of iron. This corresponds, if electrical heat is used, to 800 kilowatt-hours per metric ton of metallic iron.

The heat required to melt 1 ton of cast iron would be (theoretically) about 300 kilowatt-hours, but for the production of foundry pig-iron there would be needed an additional 175 kilowatt-hours for the production of silicon, or a total of 475 kilowatt-hours for the melting operation. Thus in round numbers there will be needed:—

	Kw. Hrs.
For reducing the iron ore to metal	800
Converting this into foundry pig-iron	500
Total	1,300

It will be noticed that I have made no specific allowance for melting the slag. This is because the gangue will be practically eliminated by magnetic treatment before fusion, and thus there will be scarcely any slag to melt.

* Actually the second stage is more complicated than I have indicated, as the iron in fusion absorbs carbon and silicon to form pig-iron, the silicon itself being derived from the silica in the ore.

In electric furnaces a working efficiency of at least 70 per cent. can usually be obtained, and therefore we find as the actual operating charges for the two stages:—

	Kw. Hrs.
For reducing the iron ore to metal	1,140
For reducing silicon and melting the iron	710
Total	1,850

The total power requirement shows a decided economy when compared with the 2,500 kilowatt-hours that would be needed for the direct smelting of the ore, even after making allowance for the cost of crushing, magnetic treatment, and double handling of the material. The first or reducing stage can, however, be carried out by means of fuel-heat instead of electrical heat without detracting from the purity of the product. The operation would have to be carried out in some kind of a muffle-furnace, as the reduced metal must be protected from the air and from furnace gases, and the efficiency of the heating fuel would consequently be very low. As, however, cheap fuel, such as waste wood, can be employed, this will not cause any serious expense. The heat theoretically needed for the reduction of the iron ore is 686,000 calories per metric ton of iron; allowing 25 per cent. efficiency, this would mean 2,744,000 calories, which would be furnished by 0.4 ton of a low grade of coal. It would appear safe, therefore, to allow for this purpose ½ ton of local coal or an equivalent amount of waste wood.

Dr. Trood and Mr. W. A. Darrah have carried out a series of experiments at Heroult, in California, on the reduction of pure magnetite ore to metallic iron. The work has been done in a small furnace making a few pounds per hour of reduced iron. This furnace was heated electrically, and in this way an exact determination could be made of the heat that was supplied to it. There was under construction at the time of my visit a large furnace for the reduction of ore which was to be heated by means of fuel. Since my visit Mr. Darrah has been made superintendent of the plant, and this has no doubt interfered with the progress of the experiments. He has, however, written me the following letter with regard to the cost of operating the Trood-Darrah process. I assume that the power-consumption used in this estimate is deduced from their small-scale experiments, and that the other expenses refer to a plant making 100 tons of metallic iron daily.

"Noble Electric Steel Company,
Heroult, Shasta County, Cal., October 23rd, 1918.

"Regarding the questions which you have raised, I have to advise as follows:—

"(1.) We have made a very substantial success in reducing magnetite-iron ores to metal by heating to a moderate temperature with carbonaceous reducing agents.

"(2.) Reduction begins in the neighbourhood of 700° C., but in order to carry the reaction to completeness, as well as to minimize the time required, we find it expedient to operate at approximately 800° C.

"(3.) For a perfect reduction of particles the size of coarse sand, with the magnetite ore that we are using we find that three hours are required. The time will vary considerably with the different grades of ore, different reducing agents, and different temperatures. Powdered charcoal is the most satisfactory reducing agent, but, of course, is not the only successful one.

"(4.) Total cost per ton of iron product, making ample allowance for power, fuel, etc., about $19.

"The costs are divided as follows:—

Item.	Cost per Ton.	Quantity required.	Total Cost per Ton of Iron.
Power for drying and reduction	½ cent per kilowatt-hour	1,200 kilowatt-hours	$6 00
Charcoal	$25 per ton	570 lb.	7 10
Ore	$3 per ton	2,760 lb.	4 15
Crushing materials	50 cents per ton	....	69
Handling materials	50 cents per ton	....	69
Labour and supervision	....	....	50
Interest and Depreciation, $20,000 Investment	....	....	10

"The above cost may appear rather high, depending upon your local conditions. It is, of course, a direct result of the price of such materials as reducing agents and iron ore, which you will note total considerably over 50 per cent. of the entire cost. The power cost, you will note, is less than one-third of the total cost.

"Dr. Trood and I consider it quite feasible to reduce the iron by our process, and melt it either electrically or after briquetting in an open-hearth furnace. It is then perfectly feasible to make either pig-iron or steel, as the market may demand."

With regard to Mr. Darrah's estimate, I may state:—

(1.) Assuming the ore to contain 67.8 per cent. of iron (published analysis), 2,760 lb. of ore would only yield about 1,870 lb. of metallic iron. It would appear from this that the estimate does not refer to a ton of pure iron, but to a 2,000-lb. ton of an impure iron product containing about 93 per cent. of iron. As this is about the percentage in foundry pig-iron, we need only increase the estimate by about 15 per cent. to provide for the change from the short ton to the long ton and for the mechanical losses in the various operations.

(2.) Mr. Darrah's estimate of 1,200 kilowatt-hours, if increased by 15 per cent., would give 1,380 kilowatt-hours, whereas my estimate, based on calculation, was 1,200 kilowatt-hours. We should for the present take the larger figure, which increases the cost by 90 cents.

(3.) The estimate of 570 lb. of charcoal, increased by 15 per cent., comes to 655 lb. This figure is supported by calculation from the equation I gave above, and I am estimating on a consumption of ⅓ net ton of charcoal; the cost of this in British Columbia will be only about $2.

(4.) The remaining items of cost must be increased by about 50 per cent. on account of the larger amount of ore to be handled. Apart from this, I cannot check them in any detail, but suppose that they would be rather higher under British Columbian conditions. The charges seem to be very small, but it should be remembered that the operation will be continuous and mechanical throughout; there will be no hard labour required, and the cost for labour, superintendence, and maintenance of plant should be small.

The following estimate of the cost of making 1 long ton of metallic iron in the form of powder by the Trood-Darrah process has been prepared in view of conditions in British Columbia:—

Cost of One Long Ton of Metallic Iron, using Electrical Heat at ½ Cent per Kilowatt-hour.

Ore, 2.2 tons at $4	$ 8 80
Charcoal, ⅓ ton at $6	2 00
Power for heating, 1,380 kilowatt-hours at ½ cent	6 90
Crushing materials at 50 cents per ton	1 10
Handling materials at 50 cents per ton	1 10
Labour and supervision	85
Interest and depreciation	25
Total	$21 00

In this estimate I have taken 2.2 tons of ore instead of 2 tons in order to cover the loss in magnetic concentration which would form the first step in the process.

If fuel can be used for heating in this operation the cost will be further reduced; thus the heat should be obtainable by the use in gas-producers of ½ ton of low-quality coal costing, say, $4 per ton. The cost of heat would thus be $2, or at the outside $2.50, and the total cost of the iron $16 or $17 per ton.

With regard to these figures, I must state clearly that, although I have full confidence in Mr. Darrah's statements, yet the operation of the process must be demonstrated on a working scale and its applicability to British Columbian ores must be shown before a commercial enterprise can be undertaken.

I should also state that I believe that foundry pig-iron can be obtained, conveniently and economically, by melting the iron powder with fluxes in an electric furnace. It will be necessary, however, to confirm this point experimentally, and also to ascertain whether the sulphur originally present in the ore will be removed sufficiently well by the proposed process.

The following estimate will give some idea of the cost of 1 ton of foundry iron obtained by melting the reduced powder in an electric furnace:—

Cost of One Long Ton of Foundry Pig-iron.

Reduced metallic powder	$17 00
Electric power, 750 kilowatt-hours at ½ cent	3 75
Charcoal, $^1/_{10}$ ton at $6	60
Electrodes, 7 lb. at 8½ cents	60
Fluxes and supplies	55
Labour	2 00
Management	1 00
Interest and overhead charges	1 50
Total	$27 00

Another favourable feature of the reduction process is that the metallic powder can be melted in electric furnaces for the production of steel without the need of first turning it into pig-iron. In this way one step of the usual process is eliminated and electric-furnace steel may be produced at very reasonable figures.

REDUCTION OF IRON ORE BY HYDROGEN.

As having a bearing on the above process, I add a brief account of the reduction of iron ores by means of hydrogen. Mr. A. T. Stuart, of Toronto, invented an improved form of apparatus for the production of hydrogen and oxygen by the electrolysis of water. In trying to find uses for the hydrogen, he discovered that iron ores are reduced to metal by means of hydrogen at so low a temperature as 700° C. The process is very convenient, because the hydrogen can be passed again and again through the ore, so that the gas is perfectly utilized. Such a process, however, would only be possible if hydrogen could be obtained extraordinarily cheaply. To produce it by electrolysis would need unusually cheap electric power, and the ore could be smelted directly with less power than would be needed to make the hydrogen and to carry out the reduction with its aid. The only condition under which the process could be employed would be if there were available during off-peak periods of a power plant large amounts of direct-current power, which could be obtained at a very low price, and if, in addition, there was a satisfactory market for the electrolytic oxygen, so that the hydrogen might be regarded as a by-product. I must add, also, that Mr. Stuart's experiments were made on hæmatite ores, and it is likely that magnetites may not be reduced so easily or at so low a temperature. One feature of the process which may prove important is that the hydrogen used to reduce the iron also serves to remove from it phosphorus and sulphur in a gaseous form.

STEEL DIRECT FROM THE ORE.

(A Process described by F. T. Snyder.)

I conclude this Appendix with an extract from a paper on "Steel Direct from the Ore," which was sent to me recently by Mr. F. T. Snyder, of Chicago, the inventor of the Snyder electric steel-furnace. I quote Mr. Snyder, as I consider that his account is of interest in connection with the present investigation, but I do not endorse his process or assume any responsibility for his statements:—

"To expose sufficient surface for rapid reduction the ore is crushed to ¼ or ⅛ inch in diameter. From an ore-storage bin it is fed into a cylindrical kiln in which the ore is dried and heated to 700° C. under oxidizing condition. The sulphur contents of the ore will be substantially eliminated in this preliminary roasting. At 700° C. the ore falls into a reducing-kiln, in which it is exposed to the action of carbon-monoxide gas, which reduces the iron oxide to metallic iron sponge. This iron sponge is conveyed without exposure to air, and while still hot, to an air-tight electric furnace. The reducing carbon-monoxide gas is generated in a gas-producer from powdered coal giving a hot gas low in carbon dioxide. At the part of the reducing-kiln where the iron ore enters, this gas leaves the kiln with about the same composition as the gas leaving the top of a blast-furnace. Part of this gas passes into the roasting-kiln, where it is burned with air from a fan to furnish the heat required to raise the ore to 700° C. before it enters the reducing-kiln. The balance of the gas from the reducing-kiln is burned under a boiler, and with the steam the necessary power is produced for the electric-smelting furnace. By a fortunate coincidence the amount of gas available is somewhat more than the amount needed by the electric furnace.

"This arrangement of equipment meets the three fundamental difficulties of the earlier attempts to make steel direct from ore, and retains the great commercial advantages of the direct method. By the use of fine ore in rotating-kilns, which both expose the ore to the acting gases and at the same time convey it, the difficulty of getting the iron sponge out and trapping the gas is made easy by the low pressure required to pass the gases through the kilns. The electric furnace melts the sponge without oxidation and eliminates the second difficulty. The use of a preheating-kiln which is separate from the reducing-kiln makes it possible to remove the reducing gases from contact with the ore before the gas is cooled to a temperature at which carbon-deposition begins, and furnishes a sponge that is practically free from carbon and ready to melt direct to steel. As the reduction is entirely by carbon-monoxide gas, no solid carbon coming in contact with the ore, the silica, phosphorus, and titanium in the ore are not reduced, but remain in their original form and are melted in the slag in the electric furnace, substantially none of them entering the steel.

"Compared with the direct method of smelting iron ore with electricity, the kiln method, with electric-furnace finishing, has the advantage of a much lower electric-power consumption. The kiln method uses 600 kilowatt-hours per ton of steel produced for all power purposes. The direct electric smelting uses 2,000 kilowatt-hours for the electric smelting producing pig-iron, and 500 kilowatt-hours for the electric-furnace operation of changing the electric pig-iron to steel. When the weight of the electrodes for the pig-iron furnace are taken into account, and the fact that the kiln method uses charcoal from twigs and leaves, the total average of timber required for both methods is approximately the same. A production of 25 tons per day requires 1,000 kw. of power plant for the direct-steel method, and 3,000 kw. for the electric pig-iron method. The difference in the investment cost for power-plant construction is 50 per cent. greater than the total cost of the kiln plant, exclusive of its power plant. If water for power is available without cost, the burden of the investment cost renders the electric pig-iron method non-commercial in comparison with the direct-steel method.

"The economic advantages of this method are:—

"(1.) The use of iron ores of inferior composition. Sulphur is eliminated in the preliminary roasting. Silica, phosphorus, and titanium enter the slag.

"(2.) The use of fuel of inferior quality. As the fuel is burned in a producer in powdered form, raw coal, coke, or charcoal may be used. Sulphur in the fuel enters the reducing gas as sulphur-monoxide gas, which is without action on the iron at the temperatures used. Powdered fuels are in reliable use with ash as high as 20 per cent.

"(3.) The production of steel of electric-furnace quality. This is substantially higher in tensile strength, elastic limit, percentage of elongation, and resistance to shock than is Bessemer or open-hearth steel of the same analysis.

"(4.) The recovery of a high percentage of the iron in the ore. Practically all the iron in the ore passes into the steel, as the electric-furnace melting makes it possible and the production of good steel makes it necessary to produce a slag substantially free from iron. With the present blast-furnace, open-hearth or Bessemer combination, from 10 to 15 per cent. of the iron in the ore is lost in the slags produced.

"(5.) Existing methods use about 1 ton of coke in the blast-furnace per ton of pig-iron. This coke requires for its production 1⅔ tons of raw coal. To turn this ton of pig-iron into steel requires an additional ⅓ ton of raw coal burnt in gas-producers. This is a total consumption of 2 tons of raw coal per ton of steel produced. The direct method, including the gas for electric power and for roasting, requires 1 ton of raw fuel. As the fuel is used powdered, if charcoal is made the small twigs and the leaves may be carbonized as well as the larger pieces, substantially doubling the steel produced per acre of timber.

"(6.) The capital investment, including electric-power plant, is about two-thirds that of the blast-furnace, open-hearth combination for the same output.

"(7.) The production cost per ton of steel ingots is about 80 per cent. of the older practice.

"(8.) Plants for small production are practical with the direct-steel method, outputs as low as 25 tons per day being efficient.

"(9.) Production may be stopped or started in a few hours if necessary to meet market or traffic conditions, without plant deterioration, and without the production of considerable quantities of lower-quality product.

"(10.) As the equipment is low, the entire plant may be traversed by travelling cranes making repairs rapid and low in cost. This latter is also aided by the general low temperatures of operation.

"(11.) As the operation is mostly mechanical, the amount of labour required is small. Skilled labour required only for supervision.

"(12.) As the gas-pressure used is low and no large quantity of molten material is held at a time, the safety of operation is materially greater than with the blast-furnace and open hearth."

APPENDIX XIII.

AUXILIARY INDUSTRIES.

In view of the limited market for foundry pig-iron in British Columbia, it will be essential to make other products, so as to increase the output of the plant. For this purpose an additional output of low-silicon pig-iron can be made, and this can be melted with steel scrap for the production of steel. Ferro-alloys, such as ferro-silicon, ferro-manganese, and ferro-chrome, can also be made in an electric-smelting plant. These auxiliary industries not only increase the general output of the plant, thus reducing, proportionately, the overhead charges, but are themselves likely to yield a higher profit than the production of pig-iron. The production of ferro-manganese and ferro-chrome in the electric furnace depends upon a supply of ores of manganese and of chromium. Quartz is required for the production of ferro-silicon.

Ferro-alloys.

Ores of Manganese and Chromium.—I have been furnished by Mr. W. F. Robertson with the following information, which indicates that there would be a sufficient supply of ores of these metals of a grade suitable for the production in electric furnaces of ferro-manganese and ferro-chrome. Quartz for the production of ferro-silicon can also be obtained.

The Curle Manganese Group.

Report by A. G. Langley, Resident Engineer, Revelstoke, June, 1918.

Report of Assays by the Provincial Government Assayer.

Sample.	Description.	Manganese.	Iron.	Phosphorus.	Sulphur.	Insoluble.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
11675	Manganese ore sacked for shipment..	34.5	...	...	...	...
11676	General sample, dumps, ore for shipment	37.5	...	...	...	...
11677	General sample, dumps, ore for shipment	36.7	...	...	...	...
11678	General sample ore in-place, No. 2 deposit	39.0	2.7	Traces	0.13	0.35
11679	Sample high-grade, No. 1 deposit....	49.5	...	...	...	...
11680	Overburden reject	17.2	...	...	...	...
11681	Iron oxide underlying	9.7	22.6	...	...	...

(Signed.) D. E. WHITTAKER.

Report on the Ore-deposit by Mr. Langley.

"The property, consisting of ten claims, is situated at a distance of seven miles from Kaslo and adjoins the Kaslo & Nakusp branch line of the Canadian Pacific Railway.

"The group was staked by A. Curle, of Kaslo, in 1917, and although the ore is freely exposed along the old Kaslo-Slocan wagon-road it escaped attention for years, due no doubt to the lack of knowledge of the character and commercial value of the deposit. In February, 1918, the property was bonded by the original owners, A. J. Curle and A. G. Larson, to Col. F. B. Millard, of Spokane.

"Seventeen men are now employed and considerable progress has been made during the last month in developing and winning the ore.

"*Character of the Ore.*—The ore chiefly consists of the soft black or brown oxides, which may be classified as wad manganese, while concretionary psilomelane, though in evidence, is less frequent in occurrence.

"*Ore Occurrence.*—At the No. 1 deposit the ore forms a blanket deposit over the surface of the flat, the average thickness of which is hard to arrive at, for its distribution is uneven and irregular, but can safely be taken as not exceeding 6 inches.

"From where the hill rises above the flat and for about 50 feet up the gentle slope, the ore, which occurs underlying a few inches of soil, shows about an average thickness of 1½ feet and appears to be of higher grade than that on the flat.

"At the No. 2 deposit the occurrence is similar to that of the No. 1, but appears to be more uniform and to contain a greater tonnage.

"This deposit has not been mined yet, and its area is less definitely outlined than that of the other. In an isolated patch at about 120 feet east of this deposit a small surface cut shows a 2-foot thickness of high-grade ore dipping slightly under a covering of about 3 feet surface wash; at this point a nice tonnage may be developed, but no work has been done to determine its extent.

"*Geology.*—Underlying the manganese-deposit, a layer of about 6 inches of soft material stained with oxide of iron is encountered, and under this a greenish clay containing pebbles and boulders of what is known locally as the Kaslo green schist. No attempt has been made to sink through the clay, which forms the floor of the deposit. Judging by the rock-exposures along the railway-cutting, the whole area is underlain by schists and slates, which have a dip of 53 degrees and a strike of N. 10° W.

"*Origin of the Deposit.*—The primary deposit of manganese probably owed its origin to deep-seated springs arising from a body of intrusive magma. These waters deposited their burden of lime, iron, manganese, and silica in veins and veinlets of the country-rock. During subsequent erosion and oxidation the manganese has been collected by surface waters and redeposited on the benches and gentle slopes of the hillside.

"The iron, being precipitated first from solution, forms the lower layer of the deposit, while the lime may have been an important factor in bringing about the precipitation of the manganese.

"That this secondary deposit is of fairly recent origin is demonstrated by the fact that it overlies glacial drift. The calcareous sinter which is invariably with the manganese, and generally overlying it, no doubt owes its origin to deep-seated springs, of which there are still a few active ones in the vicinity.

"*Mining.*—The ore being soft is easily mined by pick and shovel, but great care has to be exercised in obtaining a grade suitable for shipment, and a certain amount of sorting is necessary.

"On account of the difficulty in getting cars, no ore had been shipped up to the time of my visit. It was the intention of the owners to ship to Chicago.

"*Prices.*—The prices which were recently fixed in the United States range from 86 cents to $1.30 per unit for ore containing from 35 to 54 per cent. metallic manganese. (Refer.: *Eng. & Mining Journal*, June 8th, page 1053.) Freight rate to Chicago, $11.20 per ton.

"*Samples.*—No. 11675, taken from 800 sacks for shipment; Nos. 11676 and 11677, general grab sample of all dumps of ore, containing 110 tons; No. 11678, sample taken from a number of test-holes on No. 2 deposit; No. 11679, sample across 15-inch width of high-grade ore, No. 1 deposit; No. 11680, sample of overburden reject; No. 11681, sample of oxidized material underlying manganese.

"*Estimate of Available Ore for Shipment.*—Estimates of ore in-place are based on the assumption that 40 cubic feet equal 1 ton.

	Tons.
Total ore in No. 1 deposit	730
Less extracted	160
	570
Total ore in No. 2 deposit	835
Total	1,405

"On account of the irregularity of the deposit and the unsystematic way in which it has been prospected, the estimate is partly based on the amount that has been extracted from various areas, and where the deposit showed regularity, upon the cubic content.

"*Conclusion.*—So far the only bodies discovered that might be considered of commercial importance are the Nos. 1 and 2 deposits as shown on the plan, and although there are manganese indications in patches outlying these areas, at the present time there is not enough exposed to allow one to make an estimate of the possible ore which may or may not exist under a covering of surface wash, but the indications do not encourage one to believe that there is any large quantity.

"(Signed.) A. G. LANGLEY,
"*Resident Engineer.*"

Manganese Ore from Dickie's Claim, Cowichan Lake.

Samples taken by Mr. Turner, August, 1918.

Report of Assays by the Provincial Government Assayer.

Sample.	Manganese.	Insoluble.	Phosphorus.
	Per Cent.	Per Cent.	
No. 1, 4 feet	18.3	66.3	None.
No. 2, 6 feet	55.0	11.0	None.
No. 3, 5 feet	32.8	45.1	None.
Second lens	37.0	38.0	None.

(Signed.) D. E. WHITTAKER.

Mr. W. F. Robertson writes:— "August 14th, 1918.

"I enclose assay certificate of a manganese-deposit within a mile of the Canadian Pacific Railway and Canadian Northern Railway by wire tram, showing over 6 feet of 55-per-cent. Mn. ore carrying 11 per cent. SiO_2, with 4 feet of lower-grade ore on one side and 16 feet on the other. It looks as if we could guarantee 30 tons a day of best grade within sixty days, and possibly up to 100 tons."

Deposits of Chrome-iron Ore.

Report on Deposit at Scottie Creek by R. W. Thomson, Resident Engineer, Kamloops, May 10th, 1918.

Sample 11762 ..... 22.5 per cent. Cr_2O_3 and 27.2 per cent. silica.
Sample 11761 ..... 24.0 per cent. Cr_2O_3 and 35.0 per cent. silica.

II. Sample from Scottie Creek supplied by Provincial Mineralogist, July, 1918—

No. 1, 12974 ..... 40.5 per cent. Cr_2O_3 or 28.5 per cent. chromium.
No. 2, 12975 ..... 42.5 per cent. Cr_2O_3 or 29.5 per cent. chromium.
No. 3, 12976 ..... 24.8 per cent. Cr_2O_3 or 17.0 per cent. chromium.

Mr. Robertson informed me that there was an ample supply of this ore.

III. Sample from Juno Claim, Big Sheep Creek, supplied by P. B. Freeland, Resident Engineer, Grand Forks, July, 1918—

Sample 11471 ..... 36.0 per cent. Cr_2O_3 or 24.6 per cent. chromium.

PRODUCTION OF FERRO-ALLOYS IN THE ELECTRIC FURNACE.

The following notes on the technical requirements and the cost of making ferro-manganese, ferro-chromium, and ferro-silicon are based on information given me by Messrs. Beckman and Linden. I have, however, been able to compare their figures for the consumption of ore, electric power, and electrodes in some cases with those given in a valuable paper by R. M. Keeney, "The Manufacture of Ferro-alloys in the Electric Furnace," which was presented at the September, 1918, meeting of the American Institute of Mining Engineers. Beckman and Linden's figures refer in most cases to the operation of a 3,000-kw. furnace, and I have therefore made some

allowance for increased consumption of power, labour, etc., involved in the proposed use of a furnace of only 300 kw.

FERRO-MANGANESE.

This is made by smelting in an electric furnace a mixture of manganese ore, steel turnings, lime rock, coke, and charcoal. For the production of a long ton of 80-per-cent. ferro-manganese from an ore containing 43 per cent. of manganese the following amounts would be needed, using Beckman and Linden's figures:—

	Lb.
Manganese ore	4,700
Steel turnings	300
Lime rock	1,040
Coke and charcoal	1,400
(B. and L. give petroleum coke	1,125)
Electrodes	100
Power	0.8 horse-power year.

A small single-phase furnace of 300 kw. would turn out about 500 tons per annum, or 1½ tons per day, which would be as much as could be utilized locally.

The following estimate of the cost of 1 long ton of 80-per-cent. ferro-manganese is based on information supplied by Messrs. Beckman and Linden:—

Manganese ore, 4,700 lb. at $25 per net ton	$ 58 80
Steel turnings, 300 lb. at $10 per gross ton	1 30
Lime rock, 1,040 lb. at $3.50 per net ton	1 80
Coke and charcoal, 1,400 lb. at $8 per net ton	5 60
Electrodes, 100 lb. at 7 cents per pound	7 00
Power, 0.8 horse-power year at $15 per horse-power year	12 00
Labour	8 00
Maintenance	5 00
Supplies	1 50
Plant, general expense	3 00
Office, general expense	6 00
Total	$110 00

R. M. Keeney states that the power-consumption varies from 4,000 kilowatt-hours per long ton in a 3,000-kw. furnace to 7,000 kilowatt-hours per long ton in a 1,000-kw. furnace, which would correspond to 0.72 and 1.27 horse-power years respectively at 85 per cent. load factor. He also states that the electrode-consumption is high, ranging from 150 to 250 lb. per long ton of the product when using amorphous carbon electrodes. These results were obtained when smelting ores of about 39 per cent. of manganese, and with a consumption of about 1,300 lb. of "coal" per gross ton of product, and about 3 net tons of the 39-per-cent. ore; the recovery being about 75 per cent.

From other sources I learn that the regular practice in a ferro-alloy furnace of 1,500-kw. over a considerable period has been as follows per gross ton of 80-per-cent. ferro-manganese:—

2.5 net tons of 40-per-cent. ore, costing 80 cents per unit.
720 lb. coke at $5 per net ton.
720 lb. charcoal at $20 per net ton.
65 lb. graphite electrodes at 12 cents per pound.
0.66 to 0.85 horse-power year of 85 per cent. load factor.

The ores available in British Columbia appear from the foregoing reports to contain about 40 per cent. manganese, and comparing the various figures given above, I conclude that in a 300-kw. furnace 1 long ton of 80-per-cent. ferro would need about the following:—

40-per-cent. manganese ore, 2.7 net tons.
Coke and charcoal, 1,400 lb.
Electric power of 85 per cent. load factor, 0.9 horse-power year.
Carbon electrodes, 150 lb.
Lime rock, 1,500 lb.
Steel turnings, 300 lb.

An estimate of the cost of 1 long ton of 80-per-cent. ferro-manganese based on these figures would be as follows:—

Cost of making One Long Ton of 80-per-cent. Ferro-manganese with $15 Power in a 300-kw. Furnace.

40-per-cent. manganese ore, 2.7 net tons at $25	$ 67 50
Steel turnings, 300 lb. at $10 per gross ton	1 30
Lime rock, 1,500 lb. at $3 per net ton	2 25
Coke and charcoal, 1,400 lb. at $8 per net ton	5 60
Electrodes, 150 lb. at 7 cents per pound	10 50
Electric power, 0.9 horse-power year at $15	13 50
Labour	8 00
Maintenance	5 00
Supplies	2 00
Plant, general expense	3 00
Office, general expense	6 00
Total	$124 65

If the power were to cost 0.5 cent per kilowatt-hour, the charge for this item would be:—

0.9 horse-power year (0.85 L.F.) at $27.70	$ 25 00
And the final figure for the cost	136 15

Silico-manganese.

In steel-making it is usually necessary to add ferro-manganese and ferro-silicon to obtain a sound product. As manganese ores usually carry a considerable amount of silica, it is economical to reduce this to silicon instead of slagging it off with lime: thus obtaining a "silico-spiegel" containing both manganese and silicon. The following estimate, based on information from Messrs. Beckman and Linden, gives the cost of a long ton of silico-spiegel containing 18 per cent. silicon, 40 per cent. manganese, and 3 per cent. carbon. The ore contains 42 per cent. manganese and costs $23 per net ton.

Cost of making One Long Ton of Silico-spiegel with $15 Power in a Large Furnace.

Manganese ore, 2,140 lb. at $23 per net ton	$24 60
Silica rock, 400 lb. at $4 per net ton	80
Coke and charcoal, 1,200 lb. at $8 per net ton	4 80
Steel turnings, 950 lb. at $11 per gross ton	5 00
Power, 0.8 horse-power year at $15	12 00
Electrodes, 60 lb. at 7 cents per pound	4 20
Labour	8 00
Maintenance	3 00
Plant, general expense	6 00
Office, general expense	4 00
Total	$72 40

I have no figures available to compare with this, but increasing it proportionally with that for ferro-manganese, on account of the small size of the furnace, would give a total of about $85 per ton with $15 power, or $95 per ton with 0.5-cent power.

A higher-grade alloy might have the following composition:—

	Per Cent.
Manganese	59
Silicon	20
Iron	17
Aluminium	3
Carbon	1

The following is the estimated cost of making 1 long ton of this alloy, based on Beckman and Linden's figures:—

Cost of making One Long Ton of High-grade Silico-manganese with $15 Power in Large Furnace.

Manganese ore, 3,200 lb. at $25 per net ton	$40 00
Steel turnings, 440 lb. at $10 per gross ton	2 00
Silica rock, 380 lb. at $4 per net ton	80
Coke and charcoal, 1,800 lb. at $8 per net ton	7 20
Electrodes, 100 lb. at 7 cents per pound	7 00
Power, 0.8 horse-power year at $15	12 00
Labour	8 00
Maintenance	5 00
Supplies	1 50
Plant, general expense	3 00
Office, general expense	6 00
Total	$92 50

Increasing this total to correspond with the use of a small furnace, we get with $15 power about *$100* per ton, and with 0.5-cent power about *$110* per ton.

FERRO-CHROMIUM.

The following estimate, based on the figures of Beckman and Linden, is for the production of an alloy of the following composition:—

	Per Cent.
Chromium	65
Iron	28
Carbon	5
Silicon	1

The ore is assumed to contain:—

	Per Cent.
Chromium	31 (Cr_2O_3, 45 per cent.)
Iron	12
Silica	12
Magnesia	16

Cost of making One Long Ton of Ferro-chromium with $15 Power in Large Furnace.

Chrome ore, 4,750 lb. at $36 per net ton	$ 85 50
Steel turnings, 100 lb. at $11 per gross ton	50
Coke and charcoal, 1,200 lb. at $8 per net ton	4 80
Power, 1.2 horse-power years (0.85 L.F.) at $15	18 00
Electrodes, 100 lb. at 7 cents per pound	7 00
Labour	12 00
Maintenance	3 00
Supplies	2 00
Plant, general expense	10 00
Office, general expense	6 00
Total	$150 80

In a recent paper (September, 1918) R. M. Keeney discusses very fully the production of ferro-chromium, and the following notes are based on his paper: Ferro-chromium can be made of varying carbon contents, usually between 4 and 8 per cent. If chrome ores are smelted with an abundance of carbon, the recovery of chromium is good, being 90 or 95 per cent. of the amount in the ore, but the ferro will contain about 8 per cent. of carbon. If, on the other hand, the supply of carbon is restricted so as to keep the carbon below 6 per cent., the recovery of the chromium will be poor, about 70 or 75 per cent. The recovery depends partly on the richness of the ore, and when this is below 40 per cent. Cr_2O_3, the recovery is low.

American ores from California and Oregon are reported to contain as a rule from 40 to 45 per cent. Cr_2O_3. The ores from Scotty creek, in British Columbia, appear to have in some cases 40 per cent. of Cr_2O_3, and therefore to be rather poorer than the American ores. In making 65-per-cent. ferro-chrome there would be needed per long ton of the product:—

For an 8-per-cent. carbon product at 90-per-cent. recovery.....5,730 lb. of ore.
For a 5-per-cent. carbon product at 70-per-cent. recovery.....7,380 lb. of ore.

The power figures of Beckman and Linden are based on the statement that each pound of ferro-chromium needs 3 kilowatt-hours for its production. This may be correct with high-grade ores and in large furnaces. In Keeney's experiments, using furnaces of about 200 kw., the power-consumption was about 3.4 or 3.5 kilowatt-hours per pound, and this at 85 per cent. load factor corresponds to 1.4 horse-power years.

Beckman and Linden in their original estimate state that 1,100 lb. of petroleum coke would be needed per long ton of the product, and I converted this into 1,200 lb. of coke and charcoal. Keeney used coke in his experiments, and the amount varied from 0.5 to 0.75 lb. per pound of ferro. Taking 0.6 lb. as a mean value, we find the consumption to be 1,344 lb. per long ton of the product.

For the production of ferro-chromium in a small furnace of 300 kw. it will be safer to take the more conservative figures of Keeney, and using, as before, the remaining items from Beckman and Linden, which I have already increased a little on account of the smaller scale of operation, we obtain the following estimate:—

Cost of Production of One Long Ton of 65-per-cent. Ferro-chromium with about 6 per Cent. Carbon from an Ore of 40 per Cent. Cr_2O_3 in a Furnace of 300 Kw.

Chrome ore, 6,000 lb. at $36 per net ton	$108 00
Steel turnings, 100 lb. at $11 per gross ton	50
Coke, 1,350 lb. at $8 per net ton	5 40
Power, 1.4 horse-power years at $15 per horse-power year	21 00
Electrodes, 100 lb. at 7 cents per pound	7 00
Labour	12 00
Maintenance	5 00
Supplies	2 00
Plant, general expense	10 00
Office, general expense	6 00
Total	$176 90

If the power cost 0.5 cent per kilowatt-hour, the charge for this item would be:—

7,700 kilowatt-hours at 0.5 cent	$ 38 50
And the final cost per ton of ferro would be	194 40

Ferro-silicon.

The following estimate is given by Messrs. Beckman and Linden for the cost of making 1 ton of the 50-per-cent. ferro-silicon. The output of a 300-kw. single-phase furnace would be 400 tons per annum, or 1 ton daily.

Cost of making One Ton of 50-per-cent. Ferro-silicon with $15 Power in a Large Furnace.

Power, 1 horse-power year at $15	$15 00
Quartz, 2,400 lb. at $3.50 per net ton	4 20
Coke, 1,200 lb. at $8 per net ton	4 80
Turnings, 1,500 lb. at $10 per net ton	7 50
Electrodes, 60 lb. at 7 cents per pound	4 20
Labour	16 00
Supplies	1 50
Plant and office, general expense	5 00
Interest and depreciation, 20 per cent.	10 00
Total	$68 20

If power were to cost 0.5 cent per kilowatt-hour, the power item would be $27.80, and the whole cost $81.

Prices of Ferro-alloys.

For comparison with the figures of costs given above, I add the present and the pre-war prices of some ferro-alloys.

Ferro-manganese.—Before the war (December, 1913) the 80-per-cent. alloy sold at about $50 per long ton in the Eastern States. Its present price (October, 1918) is $250 for the 70-per-cent. alloy, with a charge of $3.50 per unit from that basis; thus the 80-per-cent. alloy would bring $285 per ton, which is nearly six times its price before the war. Before the war a spiegel (low-grade ferro-manganese) containing 20 per cent. of manganese was worth $25 a ton; at present a 16-per-cent. spiegel is worth $75 a ton, and a 20-per-cent. spiegel would be worth about $90 a ton.

The price of ferro-manganese in British Columbia must be about $20 a ton higher than the above figures, so that if 80-per-cent. ferro-manganese could be made at $150 a ton there would be a very good profit at present prices. On the other hand, the business would be impossible if prices were to return to their original level, unless in the meantime very important economies could be effected in the cost of supplies and other operating expenses.

Ferro-silicon.—Before the war (December, 1913) the price of 50-per-cent. ferro-silicon was $73 a ton, the 10-per-cent. alloy was $21, the 11-per-cent. alloy was $22, and the 12-per-cent. alloy $23. At the present (October, 1918) 50-per-cent. ferro-silicon is quoted at $160 per ton, the 9-per-cent. alloy is $55, the 10-per-cent. alloy is $57, and the 11-per-cent. alloy is $60 a ton. If the 50-per-cent. alloy can be made in British Columbia at anything like the estimated cost of $70 per ton, its manufacture should afford a good profit at present prices, and with reasonable economies should remain profitable even when prices have fallen considerably.

It will be remembered, of course, that the present market for these alloys in British Columbia is very limited, being less than a ton of each alloy daily. One reason for making ferro-alloys will be to supply them to the steel-making department of the plant, which otherwise would have to buy these alloys at excessive prices, and as the steel industry develops the outside market for the alloys will increase.

The design and cost of the plant and furnaces for making ferro-alloys have been considered in other parts of this report.

STEEL-MAKING.

In order to be able to make pig-iron on as large a scale as possible, and also with a view to combining more profitable industries with that of iron-smelting, it is desirable to introduce into the electric-smelting plant furnaces and other appliances for making steel. The general scheme suggested is that about 25 tons of foundry iron should be produced daily for sale to iron-foundries, and a further 25 or 30 tons of white pig-iron should be made for conversion into steel in the same plant or elsewhere. The steel would probably be made in small open-hearth furnaces heated by oil, or in electric furnaces of the Heroult type. Together with 30 tons of pig-iron, about 60 tons of steel scrap could be used if desirable, thus yielding about 85 tons of steel daily. This could be used in part for making steel castings, and the remainder could be rolled into rods and bars of small section in a small rolling-mill. The manufacture and the use of steel are too well known to require any discussion in this report, and it would be impossible for me to treat the subject adequately in the space and time at my disposal. A rough estimate of the cost of a steel plant has been given in Appendix IX., and I may add the following estimate, made by Lyon and Keeney in 1915, for the cost of electric steel-making in the Western States (Trans. Amer. Electrochem. Soc., 1915, XXVIII., page 158) :—

Cost of Production of One Long Ton of Steel in the Electric Furnace in the Western States.

1.1 tons of scrap at $15 per ton	$16 50
Slag materials	1 00
Ferro-alloys	1 00
800 kilowatt-hours at 0.20 cents	1 60
Labour	2 50
Maintenance and repairs	2 40
20 lb. of electrodes at 5 cents	1 00
Amortization and depreciation at 5 per cent. each	1 50
Interest at 6 per cent.	90
General	1 00
Royalty	50
Total	$29 90

The present cost of making steel in British Columbia will be considerably higher than this estimate, on account of the higher cost of supplies and operation.

The present price (October, 1918) of steel billets in the Eastern States is about $50 per gross ton, which might correspond with about $70 in British Columbia. The price in December, 1913, was $20 to $22 in the Eastern States. There would, however, be no attempt, under normal conditions, to compete with heavy structural material, and there are many purposes for which steel can be made at a profit, under present conditions in British Columbia, even in electric furnaces using power at 0.5 cent per kilowatt-hour.

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DEPARTMENT OF LANDS

REPORT ON THE SUBDIVISION OF CERTAIN LANDS FOR RETURNED SOLDIER SETTLEMENT

NEAR FORT ST. JAMES, STUART LAKE, COAST DISTRICT RANGE FIVE

By

J. H. GRAY, B.C.L.S.

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AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

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1919.

FOREWORD.

By Order in Council dated August 9th, 1918, certain lands in the Stuart Lake and Stuart River Valleys were reserved for soldier-settlement purposes. A large amount of the land included in this reserve was formerly held under applications to purchase and surveyed as such into blocks of 640 acres each. During the summer of 1918 Mr. J. H. Gray, B.C.L.S., was employed in charge of a party on the subdivision of these lots into areas of approximately 160 acres each.

The following is Mr. Gray's general report on the area covered by this work.

T. D. PATTULLO,

Minister of Lands.

Victoria, B.C.,
January, 1919.

Report on the Subdivision of certain Lands for Returned Soldier Settlement near Fort St. James, Stuart Lake, Range 5, Coast District.

Situation and Extent.

The tract subdivided this season and examined in detail consists in all of 61,359 acres situated upon either side of Stuart River, directly south and east of Fort St. James, at east end of Stuart Lake.

Three Groups.

This entire area, on account of location and physical variety has been divided into three groups—viz., A, B, and C—to which reference shall be made.

Group A.—This group comprises forty-six originally surveyed lots or parcels of land, aggregating 22,917 acres, situated on the west or right bank of the Stuart River, directly south of Stuart Lake, having a river-frontage of nearly ten miles, with a general depth, southerly, of five miles.

Group B.—Group B comprises fifty-two original lots, aggregating 28,539 acres, occupying an area some seven miles square, north and east of Fort St. James, at the east end of Stuart Lake.

Group C.—Group C includes fifteen original lots, containing 9,220 acres, lying to the south-east of Fort St. James, in the valley of Necoslie River, which flows north-westerly into Stuart River, where the latter leaves that lake.

Total Area of Subdivision, 61,389 Acres.

Relative Situation and Sketch-plan (A, Yellow; B, Green; C, Red).—These three groups, aggregating 61,389 acres, are distinctively coloured yellow, green, and red upon the small-scale map accompanying this report, and through which their relative positions and separating causes may be ascertained.

Group A.

Comparison with other Groups.—Group A (22,917 acres) of the land so far subdivided includes more generally and to a greater extent than the other two groups areas possessing the requisite and attractive conditions inviting to settlement—viz., the best of soil, light clearing, with a percentage of open land, regular surface, and, with the exceptions noted, good water-supply; moreover, a fairly good wagon-road connection already established with railway communication.

Classification.—The total, 22,917 acres, contained on Group A has been divided as follows:—

	Acres.
First-class land	19,377
Second-class land	2,080
Third-class land	960
Muskeg land	500

The land on the area specified "first-class" consists of a light and dark chocolate-coloured loam, extremely consistent as to grade, irrespective of tree-growth, throughout the whole tract.

First-class Lands, 19,377 Acres.—This soil is very fine in texture, thereby containing capillary moisture to a maximum extent. In August last it was necessary to only kick up an inch or so of soil to find dampness.

It would appear that the soil deepens in colour and possibly becomes more "clayey" upon the Stuart bank, but at no point were found churnings or lumps, resulting from vehicular traffic that might not be easily pulverized in one hand.

This land is entirely free from stones or rock, and excepting the steep sides of the trough of Todd Creek, about 60 feet deep, and a few lateral gullies, there is nothing to prevent, but the standing timber, the whole area from being ploughed.

The overlying leaf-mould or humus varies from 2 inches to ½ inch in depth, dependent upon tree-growth. Poplar creates the greatest thickness, decreasing to but a thin covering where solely evergreen timber prevails. In the same way the natural covering of wild grasses, vetches, and berry-bushes, for the most part luxuriant amongst poplar, diminishes in extent in proportion to the greater or sole evergreen growth, but, as before stated, the excellent character of the land or soil remains unchanged.

Second-class Land, 2,080 Acres.—Under the heading of "Second-class Land" is soil generally a lighter quality of loam, intermixed with a varying percentage of gravel and boulders, the latter on the higher elevations or tops of local ridges. These areas, although cultivable, would not at the present time be sought, nor attract attention, except as possible cattle-runs, whenever the more attractive areas become "fenced in."

This indifferent land is found on the westerly boundary of group, from Lot 1646 south to Lot 1605.

Third-class Land.—The third-class area (960 acres) may be eliminated entirely from any sphere of utility, beyond a possible supply of building-timber. Otherwise this is an area of useless land, occupying practically the whole of Lot 1648 and centre of Lot 1649.

Merchantable timber comprising fir, spruce, and pine is found here; the whole aggregating a supply of some 7,000,000 feet, which, although possibly a useful adjunct to near-by settlement, could not compare with other sources of similar supply, approximate generally to the settlement area.

Muskegs are scattered.—An area of 500 acres of this class of land is to be found in Group A, about 70 per cent. of which is open. Pending more data as to the feasibility and cost of drainage, these have been classed as "lost lands" at the present time.

Unlike other classifications, muskeg is by no means isolated, but occurs at various intervals ranging in extent from 2 to 40 acres. Their position and extent in relation to each quarter-section may be learned from the detail reports.

CLEARING, GROUP A—FIRST-CLASS LAND, $21 PER ACRE (AVERAGE COST).

The following remarks in respect to clearing relates to the area of first-class land only, some 19,377 acres.

An attempt has been made to estimate the cost of preparing the surface for rough-ploughing in the various degrees of tree-growth. This cost ranges from the minimum in open poplar through changing percentages of this timber with spruce and pine and willow, to a maximum in sole evergreen growth.

Useful Timber eliminated.—In the figures of estimated clearing cost of the first-class land area there has been eliminated some groves of "building" spruce and pine, having a diameter of from 12 to 14 inches and aggregating about 500 acres in extent.

This has been done in the belief that the value of such timber is greater than the cost of removal, which removal under ordinary circumstances would be brought about only by degrees, as requisitioned for useful purposes. The enclosure of this class of timber under the head of ordinary clearing, where the material to be removed is valueless except possibly for fencing, would tend to mislead.

Clearing Cost under $21 per Acre.—It has been adjudged that with this elimination the maximum cost of ordinary clearing would not exceed $30 per acre, nor again cost less than $10, and hence is estimated the following:—

1,000	acres costing	$30 00
6,641	acres costing	25 00
6,368	acres costing	20 00
4,151	acres costing	15 00
717	acres costing	10 00
18,887	acres averaging	$20 81 per ac.

Relating to the above figures, I beg to repeat here what was written in my sub-report of August 18th last:—

"Before concluding, a word on the subject of clearing cost. In body of report are quoted figures of cost in relation to various localities.

"I recognize the risk in stating a price, especially in the absence of any practical experience. It might be explained, however, that what has been quoted is an endeavour to

obtain an average rate over the whole parcel dealt with, unless otherwise specified. This would greatly vary in accordance with the manner in which the work was executed. I have tried to base my estimate of cost upon operations as usually followed by the ordinary settler—viz., of cleaning up the open and easier patches of land at his disposal and permit time to work upon his heavier woods (supposedly already slashed or killed).

"Should it be determined to clean up, say 50 square acres forthwith, the cost would certainly exceed my figures. Again, if 'straight-ahead' clearing were to be organized and prosecuted upon a community and large scale, I am of the opinion that they would be largely reduced."

There shall be found many quarter-sections in which, by following the stretches of more or less expansive open land or light tree-growth, it would be possible to clean up acreage under the minimum cost stated, and in many cases practically without.

NATURAL WATER-SUPPLY.

Owing to the low altitude of the flanking ridge on the south (the watershed between this and the Nechako Valley), streams are infrequent, the water-supply here being confined practically to Todd Creek, which, after receiving Rabbit Creek, its principal feeder, some two miles within the tract, flows northerly, parallel to the Stuart River, *but in the opposite direction*, in a trough some 60 feet deep.

Numerous small lakes or ponds are scattered about; these, however, could not be counted upon to contribute potable water-supply during the summer months.

The Stuart River bounds the tract on the east, providing a bountiful water-supply of excellent quality (although not always convenient) to the areas adjacent.

PERCENTAGE OF DRY QUARTER-SECTIONS.

The distribution of the natural water-supply, as is usually the case, is inadequate to meet the general demands of the entire settlement area.

The first-class land as at present subdivided is composed of quarter-sections or parcels of land to the number of 128. Of this number, seventy-two are without a natural supply of good water, or about 56 per cent., while on fifty-six subdivisions, or 44 per cent., a good water-supply was found.

WELLS.

What difficulties may be encountered in the sinking of wells is not known, since, owing to the absence of any settlement on this the west side of Stuart River, no undertaking of this description has been attempted. On the east or Fort St. James side wells have been sunk and water found at varying depths, from 20 to 40 feet.

An amelioration of this situation could, of course, be effected by varying the subdivision so as to distribute the existing supply to the greatest extent possible, since where found, principally Stuart River and Todd Creek, this essential is good and abundant. The lakes and ponds referred to would answer for stock.

TRANSPORTATION, GROUP A—30 MILES FROM RAILWAY.

The Government wagon-road from the Grand Trunk Pacific Railway at Vanderhoof to Fort St. James traverses the length of Group A, being practically twenty-five and thirty-five miles respectively from the former place and railway at its south and northerly boundaries. This road is used by automobiles in the summer and is a fairly good means of communication, subject to the usual disabilities attending country roads during change in seasons. Connection with the railway could be much reduced and still pass through a good line of country at its southerly end.

The crossing of the Stuart River to Fort St. James is at the present time by cable-ferry. A bridge just below the present ferry-site would be a simple affair.

SETTLEMENT SHOULD BE INAUGURATED IN GROUP A.

Group A, just described, constitutes the most favourable field in which to start settlement. The place within it at which a community point or headquarters should be established is on the present wagon-road at the point on west boundary of Lot 1551, where a bend in Todd Creek crosses and recrosses that line. This combines good water-supply with established line of

communication, besides being approximate to several sleigh-roads and trails which traverse this tract in various directions. It is central and some of the most attractive subdivisions in the group surround it.

Cattle and Winter Feed.—Since a small herd of cattle shall be an essential adjunct to the settlers' undertaking, the question of available winter feed, in the beginning at least, is of first importance. Wild hay meadows of any extent in Group A are held under Indian reserve, excepting that in Lot 1656, which lot is already Crown-granted.

The lack of hay meadows here could be effectually met by utilizing temporarily, upon a community basis, the areas of this description in Group B; also the acquisition of Lots 1654 and 1656 may be considered advisable on general grounds.

LUMBER—LOCAL PRICE $35 PER 1,000 FEET B.M.

Mill now operating.—A small mill is now established on the north shore of Stuart Lake, about six miles from Fort St. James. This turns out much more material than present needs require, and possibly there may be found cured lumber in stock. The present rate is $35 per 1,000 feet B.M.

Mill-site.—Should it be determined to augment this institution, there is a convenient and reverted Timber Limit 638P, Lot 4932, three miles from river-mouth on north shore of Stuart Lake, which would be available for a mill-site if water and a sheltered nook exists in which to place the plant. This shelter is requisite since this shore of the lake is exposed and shallow.

STUART LAKE MAIN TIMBER-SUPPLY.

Access to Stuart Lake.—The main timber-supply for not only Group A, but the entire settlement area as proposed, shall come from Stuart Lake, and there is no finer timber in the north than found on its shores. It would therefore seem desirable that access to the lake from within Group A should be secured.

Mouth of Stuart River Best Shelter.—Attention is directed to the alienated area lying to the north and east of Lot 1665, whereby this access would be effected, and what perhaps is of more importance, control over the sheltered waters within the mouth of Stuart River. This question, however, requires more research and expert decision.

GROUP B, 28,539 ACRES.

This group occupies a shallow valley stretching north-easterly from the south end of Stuart Lake for a long distance.

General Description.—The area subdivided includes not only all the good land which lies in a strip some eight miles in length, averaging three miles wide, but extends north and south from this strip up the slopes of the flanking ridges in second- and third-class areas.

Tree-growth.—Evergreen growth in spruce and pine is in greater percentage and heavier than in the lands hitherto described, resulting in greater clearing cost. Open or hay meadows are found to a greater extent, as are also *drainable* muskegs. The general altitude is also greater than in Group A.

Group B suitable for Stock-raising.—In a general way Group B is better adapted for stock-raising than any other of the lands reserved, and beyond the few choice locations in the neighbourhood of Stuart Lake it is likely to be sought for this purpose, combined with a minimum of mixed farming. The whole district lends itself to the production of fine stock, in which, besides the luxuriant natural feed, the presence of a maximum of lime in the water may have something to do.

It is a good horse country, in many instances these run out all winter, but this is not advantageous treatment. A safe estimate would be three and a half months feed for horses and five months for horned stock.

The limited experience so far as practised seems to demonstrate the breeding of local animals with imported bulls to be more successful than the importation of unacclimated beasts —the same with horses.

Classification.—The 28,539 acres contained in Group B have been divided as follows:—

	Acres.
First-class land	13,465
Second-class land	11,752
Third-class land	1,940
Muskeg land	1,382

First-class Land, 13,465 Acres.—The first-class or really good areas of Group B are composed of the same chocolate-coloured silt met with in Group A. There is by no means, however, the same depth of this soil, nor its widespread and consistent excellence. These remarks would not occur only in comparison with such an exceptionally good tract of land as is found in Group A.

In the matter of open land or hay meadows and water-distribution it is better served than either of the other two groups, while the eight sections nearest to Fort St. James offer to immediate settlement inducements quite as attractive.

Hay Meadows.—In the acreage stated for first-class land is included 400 acres of what may be termed wild hay meadow, from a proportion of which hay is now being taken.

It is to this area reference was made in speaking of "winter feed" for settlers in Group A. Where it occurs the covering growth is willow, the removal of which is not costly, so that preparation for even only the wild grasses and their (meadow's) enlargement would guarantee the economical wintering of so much more stock.

Second-class Land, 11,752 Acres.—Second-class land, 11,752 acres, of same character as already described, occurs as the slopes of the adjacent ridges lying north and south are ascended. Owing to the large percentage of evergreen growth, summer feed in places is scant, but at least one-half of this area would be excellent cattle-run.

Third-class Land, 1,940 Acres.—Third-class land, 1,940 acres. This area consists for the most part of rocky tops of the flanking hills, and beyond the (in many cases) good growth of milling-timber are of no value.

Muskeg, 1,382 Acres.—This area is practically contained in one locality, known as the "Grand Muskeg," occupying portions of Lots 4752-4751 and 4725, on the imperceptible height of land between the waters flowing westerly into the east end of Stuart Lake and those into Ocock River on the east, the waters of which, after first flowing into Pinchi Lake, also reach Stuart Lake farther to the north and west. This muskeg is considered "drainable" at reasonable cost, but estimating this cost would require such examination as has not been given.

Lime.—It might here be remarked that, relative to the reclamation and "sweetening" of any such land, the district abounds in limestone, from which an excellent article of lime has been produced, and should be economically procurable.

Clearing, Group B—First-class Land, $25 per Acre.

The clearing cost relates only to the area included under head of first-class lands—viz., 13,465 acres. This has been determined at the average rate of $25 per acre.

Areas near Fort St. James.—The area referred to as "nearest Fort St. James offering inducement to immediate settlement" might be placed somewhat lower, since quite open land is to be found at intervals.

Clearing Second-class Land.—Clearing second-class land is placed at $30 to $35 per acre, and would include a large percentage of good building spruce and pine.

Natural Water-supply, Group B.

A glance at the map indicates that many small streams, all providing a perennial supply of excellent water, flow down from the northerly ridge and meander through the length of the better lands.

Subdivision.—The first-class area, 13,465 acres, consists of eighty-seven quarter-sections or parcels of land.

Percentage of Wet and Dry Parcels.—Of these, fifty-one, or practically 60 per cent., have access to a natural water-supply, while thirty-six or 40 per cent., are without water.

Lakes.—The two lakes that occur in Group B both contain good water.

Wells.—No wells have been sunk in this locality; it is, however, thought that no difficulty will be found in getting water at reasonable depth.

Transportation—Principally Hay-roads.

As stated, a Government wagon-road connects Fort St. James with the Grand Trunk Pacific Railway at Vanderhoof, a distance of about thirty-eight miles. This same road extends another mile to the Roman Catholic Mission on Stuart Lake. From the "Mission" the Manson Creek (Government) Road is roughly constructed and runs northerly, as shown on accompanying sketch map, to the northern boundary of tract.

Another road (the old McLeod Lake Trail) starts at Fort St. James and traverses the southerly tier of good sections to the east boundary, and a branch road from this crosses north-easterly and traverses easterly to the same boundary the northerly tier of good lands, so that Group B is already fairly well equipped with lines of communication, such as they are.

These roads have been constructed partly by settlers and to a large degree by the Indians, their principal use being for haying operations (teams and wagons) in the late summer and hauling of hay from the stacks in the winter months, for both of which duties they answer fairly well; during change in seasons, however, they are impassable for wagons.

GROUP C, 9,220 ACRES.

That portion of Group C which was subdivided this season consists of a small portion at its north end of the reserved area lying in the valley of Necoslie Creek, and which may be said to be the inferior portion of this large and excellent tract of land. This inferiority relates particularly to those parcels lying on the southern slopes of the dividing ridge between this and Group B and to the north of the strip of pre-empted lands. It is in this locality that the second-class land noted below occurs. To the south of the pre-empted areas are excellent lands, quite ready for immediate *further* settlement.

A report will follow, made upon the subject of pre-emption improvements in this locality, in which it will be shown that these have been carried on to a considerable extent.

Classification.—Group C has been divided into two classes only, first- and second-class lands, viz.:—

	Acres.
First-class land	7,140
Second-class land	2,680

First-class Land.—The first-class land is of same composition as in Group A, and similar conditions as to depth and consistent grade prevail; generally speaking, however, the clearing is somewhat heavier.

Necoslie Water-flow.—The Necoslie River is a stream of dimension in flood, being from 75 to 100 feet wide and probably reaching a depth of 3 feet, which conditions are changed, however, in autumn to a small run of water forming pools between shallow ripples; abundant water, however, for all needs.

Necoslie Trough.—The stream itself is tortuous, winding across the intervening flats from foot to foot. These flats are open to a large extent, or except where covered with a light growth of poplar and willow. These locations offer opportunities for a small start with little preparation.

The foregoing remarks relate to the first ten miles of the stream, practically to the point where it traverses the north-east corner of the "allotted areas," beyond or to the south of which, through the reserved lands, the river flows closer to the surface of the adjacent ground.

Second-class Land, 2,680 Acres.—As stated, the second-class land, 2,680 acres, occupies almost entirely the northerly end of Group C, and not more than 60 per cent. of this area could be counted of much use for grazing purposes. The fine growth of timber found here, however, will be valuable.

Meadows and Muskegs.—The extent of this class of lands is negligible; that is to say, no extent of either is found in one place.

CLEARING, GROUP C—FIRST-CLASS LAND, $24 PER ACRE.

The tree-growth over Group C may be termed patchy, in so far that, although the mixed timber—poplar, spruce, and pine—prevails, all three are found in distinctly separate and unified groves, but, as in Group A, without change in the supporting soil. The cost of clearing the first-class land, 7,140 acres, has been estimated at $24 per acre, and this rate may be considered on the high side.

NATURAL WATER-SUPPLY, GROUP C.

Outside the Necoslie itself the water-supply is poor. Group C as subdivided consists of forty-five subdivisions, of which twenty-seven, or 60 per cent., are supplied with water, while on eighteen, or 40 per cent., no water was found.

Transportation, Group C—Poor.

An ill-made or simply "swamped-out" road over which teams may be taken in summer extends through the length of the pre-empted lands as shown. This road starts at Fort St. James and dwindles into a trail ten miles out.

Climate.

Judging from the experience of people who have lived in this locality, the climate is healthful and invigorating. The summers are not excessively hot and showers are frequent up to the middle of August; the autumn is usually dry. Extreme winters last five months; sometimes only four, November to March. Low thermometer is never accompanied with wind. Blizzards, as also floods and droughts, are unknown.

Very cold snaps (—30° to —40°) occur each winter; these vary, but are usually of short duration, or three days. The average winter thermometer is around zero.

Precipitation.—The Dominion Meteorological Department has a station at Fort St. James under the direction of Mr. O. W. Murrey. From this source the average rain and snow fall for the past twenty years has been determined as 15.35 water-inches per annum.

Elevation—Stuart Lake, 2,200 Feet above Sea.

The elevations relative to each other and to Stuart Lake were determined throughout the three groups. Obtaining this information was incorporated with other survey-work, so that contours could be available for a topographical plan. These results have not yet been deduced, but it may be stated that, taking Stuart Lake to be 2,200 feet above the sea-level, the first-class land will be found to lie approximately as follows:—

Group A	2,200 to 2,430 feet above sea-level.
Group B.	2,250 to 2,500 feet above sea-level.
Group C	2,175 to 2,300 feet above sea-level.

Work of Survey.

It is not proposed to more than touch upon this subject at the present time, since the data obtained has not been fully made up, but to delay that report until such time as full returns shall have been completed.

Employees.—Two surveying parties were engaged; two surveyors and one assistant with eight returned soldiers and a cook left from Victoria in July last. This force was augmented on the ground, as the purposes of the work demanded, by engaging Indians and later another returned man.

Standard of Old Surveying-work.—The standard of the previous surveying applied to the original sectional subdivision was found to be excellent. The limit of error established for the subdivision survey having in no case been approached—in fact, excepting in the case of a few intersections, the joining error or difference, both in the cross-chaining and distance off old post, was negligible. The markings on old posts were scrutinized. In one case only was a correction made.

A detail report upon this and other matters pertaining to and resulting from the conduct of the work will be submitted.

Soil Samples.

Some twenty-four samples of soil were obtained from different points over the three groups. These samples were boxed to be forwarded the week after my departure from Fort St. James, but this has not been done. Word was received some ten days ago that they had been traced and were on their way. These with diagrams will be submitted whenever received.

Total Lands reserved, One-half subdivided.

Area of Reserved Lands not subdivided.—The area subdivided is about one-half that covered by the instructions, which governed the work last season. The remaining area contains all the lands on east side of Stuart River, back to and across the Necoslie River, practically to its head. Speaking from a knowledge of this tract, it may be said it will be found to compare favourably, for the most part, with Group A.

In this connection it might be remarked at the present time that in the matter of transportation it should not be overlooked that the Stuart River offers an excellent and alternative line of communication direct with the Grand Trunk Pacific Railway, not only passing through these unsubdivided areas to the south-east, but as a probably more economical means of handling freight in the summer months to Groups A, B, and C.

Distance by Stuart River to G.T.P. Rly.—The distance by river from the present Stuart River ferry to the railway is sixty-seven miles, forty-two of which is good water. The lower river is swift, one rapid, and has been improved for navigation by the Dominion Government. There is no impediment that boats up to 25 tons, properly equipped, could not successfully and regularly negotiate during six months in the year.

Cross-road from Lot 2785 to Railway.—An excellent "cross-country" line for wagon-road connection with the railway (G.T.P.) exists from a point on west bank of Stuart River in Lots 2785 or 2786. Such a road would reach the railway at Vanderhoof in thirteen or fourteen miles, and strike the lower reserved lands at a half-way point on Stuart River, with an excellent slow-flowing stream on either side (up and down river), besides tapping to the east a natural ascending grade to the back lands.

EXPERT REPORT ON STUART RIVER VALLEY.

The following synopsis, in part, of a report based upon screenings and analyses of soil samples, made a few years ago by a land expert, Mr. Woods, as emphasizing the merits of this tract of country as a favourable field for settlement, may be interesting. He says in his report:—

"*Area.*—102,000 acres.

"*Location.*—In Central British Columbia, near the Grand Trunk Pacific Railway, at the foot of Stuart Lake and along the Stuart River for about forty miles.

"*Stuart Lake Basin.*—An old glacial lake, probably 200 miles long, with numerous arms and variable width—probably 100 to 200 feet deeper than the present lake and containing numerous islands which are now hills.

"*Now partly drained* down to the present lake, the 'pot-holes' of the old glacial lake.

"*The Silt Area.*—All the space between the present lake-rim and the old basin-rim.

"*The Lake-bed Soils.*—The humus: 1 to 3 inches of black vegetable mould.

"The 'white silt': 1 to 3 inches of volcanic dust.

"The 'chocolate loam': 4 to 12 feet of volcanic dust, formed as lake sediment in successive layers from 2 to 12 inches thick, with marine grass-roots and a large content of organic matter in each layer.

"The 'deep silt': A great deposit of fine volcanic dust underlying the chocolate loam to an unknown depth, but observed in the cut-banks of the river to a depth of 60 and 80 feet.

"'The finer the richer': The rule for all soils. (Fletcher on 'Soils,' page 25.)

"Silt and clay particles: These constitute the richness and durability of all soils.

"*Percentages of Silt and Clay in Different Soils.*—(8,671 samples analysed by United States Department of Agriculture from United States soils.) Of the many given, three highest are quoted:—

	Per Cent.
Clay soils	78
Silt loams	80
Silty clay loams	86

"*Stuart Lake Soils analysed*—

Stuart Lake and River 'white silt'	86.3
Stuart Lake and River 'chocolate loam'	86.8

"They are easy to work, are mellow when ploughed, and can be ploughed at any time.

"*Organic Matter in Various Soils.*—Of the many percentages given in Mr. Woods's report, a few of the higher and the highest are quoted here:—

	Per Cent.
Average soils, the average of many	2.30
North-eastern States (highest for average soils)	3.73
Average for rich silt soils	5.30
Yasoo bottom silt (Miss.)	7.37
Putah Valley dark loam (Cal.)	7.12
Arroyo Grande Valley dark loam (Cal.)	6.23

"The Yasoo bottom and the Arroyo Grande soils, mentioned above, are considered to be among the 'richest known soils.'

"*Organic Matter in Stuart Lake and River Soils*—

	Per Cent.
Stuart Lake and River 'white silt'	6.59
Stuart Lake and River 'chocolate loam'	6.72

"NOTE.—All of the above samples for organic matter undoubtedly include a portion of the top humus soil, except the samples of the Stuart Lake and River soils, which do not include any of the humus."

Speaking at length in respect to plant-foods and nitrogen especially, the report sums up:—

"With a top humus and over 6 per cent. of organic matter in its main soil and subsoil bodies, the Stuart Lake and River sediments are sure of surplus nitrogen-supply for an indefinite period."

On the question of moisture Mr. Woods has to say:—

"When at any time the amount of rainfall entering a soil becomes greater than the water-holding capacity of the soil, losses by percolation will result. The bad effects of excessive percolation are twofold: (1) The actual loss of water; and (2) the leaching-out of salts that may function as plant-food. The quantity of nutrient elements lost annually from the average soil in a humid region more than equals that withdrawn by the crops.

"*Unsurpassed Qualities of the Stuart Lake and River Sediment Soils.*—First: The finest texture couples with easy tillage.

"Second: A large excess in mineral plant-foods, as shown by all the analyses of silt soils.

"Third: An organic content in excess of the richest silt soils and far in excess of average soils. No other soils known to the writer or mentioned in the many soil authorities consulted so fully combines *richness, durability, and mellowness for easy working* and for the *conservation of moisture.*

"This could only occur, as in this case, where a wind-carried volcanic dust has been deposited in water and remained undisturbed under water until it accumulated a large organic content. Water-carried soils (alluvial soils) cannot preserve all of these qualities.

"In a word, these lake-bed sediments take the highest rank for fineness and durability, for ease of working, and for range of crop and capacity.

"*Conservation of Moisture and Soil Strength.*—The smallness of the rainfall at Stuart Lake and River (15.35 inches) is more apparent than real. The snow melts in March and April, about 13 inches enter the ground from March 1st to September 1st, during the period of growth and maturity, *and it is all utilized.* There is practically no 'run-off' and no sinking beyond the reach of crops. The soil is porous enough to let it soak in, but fine enough to hold it by capillary force, without its sinking away as in sandy soils. Further, there is no leaching or flooding away of plant-food elements. Heavy rainfall hinders agriculture and wears out the soil by washing out its values.

"'Enough but not much' describes the Stuart Lake and River precipitation.

"In 'Soils,' by Lyon Fippin & Buckman, page 271, it is stated that of a 28-inch rainfall, one-half runs off, one-fourth evaporates, and one-fourth is used by the crop.

"*Clearing Land.*—Timber of fence-pole size; slashing and burning (by hand), $5 to $12 per acre; grubbing, $5 to $10 per acre. Eighty per cent. of the land could be cleared, grubbed, and ploughed in a single operation by a simple machine of proper size at less than $5 per acre."

All of which is respectfully submitted.

J. H. GRAY, M.E.I.C., B.C.L.S.

(Note.—Further detailed reports and maps will be available later.)

VICTORIA, B.C.:
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1919.

RETURN

Of Correspondence between Hon. John Oliver and Rt. Hon. Sir R. L. Borden, Prime Minister of Canada, and other Members of the Provincial and Federal Governments, touching the Matter of a Conference of Provincial Premiers and Members of the Dominion Government held at Ottawa, November 19th to 23rd, 1918.

JOHN OLIVER,
Premier.

Premier's Office,
31st January, 1919.

TELEGRAM FROM HON. JOHN OLIVER TO RT. HON. SIR ROBERT L. BORDEN.

VICTORIA, B.C., September 27th, 1918.

Right Hon. Sir Robert Borden,
Ottawa.

B.C. Government strongly are of opinion that a round-table Conference of Provincial and Dominion Premiers necessary to formulate plans for concerted action in respect to caring for returned and returning Canadian Military Forces and their dependents.

JOHN OLIVER.

TELEGRAMS FROM RT. HON. SIR ROBERT L. BORDEN TO HON. JOHN OLIVER.

OTTAWA, ONT., October 21st, 1918.

Hon. John Oliver,
Premier, Victoria.

Your telegram 27th September has just reached me. I hope to arrange for a Conference before 15th November, at which matters you mention can be taken up.

R. L. BORDEN.

OTTAWA, ONT., October 25th, 1918.

Hon. John Oliver,
Premier, Victoria.

On account of Federal loan campaign it is thought inadvisable to call the proposed Conference of Provincial Premiers before Tuesday, nineteenth November, and it has been summoned for that date. We trust that this slight postponement will not occasion any inconvenience. In view of several important subjects requiring consideration, we have decided to summon the Premiers of all the Provinces for the date mentioned, and formal notice goes out to-day.

R. L. BORDEN.

OTTAWA, ONT., October 26th, 1918.

Hon. John Oliver,
Victoria, B.C.

"It is the desire of the Dominion Government to have a Conference with the Provincial Premiers in Ottawa, commencing on Tuesday, November 19th, for the purpose of considering

the problem of soldiers' settlement, the general problem of land settlement, and the request of the Prairie Provinces for the transfer to them of their natural resources. Other subjects for discussion may be proposed. We earnestly request your attendance; Conference should not occupy more than three or four days.

R. L. BORDEN.

MEMO. FOR CONSIDERATION OF CONFERENCE OF DOMINION AND PROVINCIAL GOVERNMENTS.
Held at the City of Ottawa, November 19th, 1918.
(Submitted by Hon. John Oliver and Hon. T. D. Pattullo.)

Hon. Frank Carvell,
Chairman.

DEAR SIR,—When the Government of British Columbia received the telegram of the Hon. Sir. Robert Borden, Prime Minister of Canada, extending an invitation to attend this Conference, it was under the impression that any and all subjects which might suggest themselves to the Conference would properly be subject of discussion by the Conference.

Upon the opening of the Conference, practically the first question which urged itself upon the attention of the Conference was the question of the transference to the Prairie Provinces of the unalienated natural resources of those Provinces, which question, it was stated by representatives of the Federal Government, was specifically a matter for the consideration of the Conference.

To the representatives of British Columbia it was clear that the claims of British Columbia for the return of lands formerly conveyed by the Province of British Columbia to the Dominion in aid of the construction of railways, while much the same in principle as the claims of the Prairie Provinces, were of an even stronger character, and a request was made to the Conference that the claims of British Columbia should be considered.

To our surprise it was clearly stated by representatives of the Dominion Government, that, as British Columbia's claim was not specifically upon the list of subjects prepared by the Dominion for consideration by the Conference, therefore the said claim could not be considered at this Conference. This position, however, was modified, and the statement made that if the Conference so desired the case of British Columbia could be considered. Thereupon the Conference did indicate its desire that the claim of British Columbia should be considered.

After some discussion the suggestion by representatives of the Dominion Government, that the representatives of the Provinces should meet apart from the representatives of the Dominion for the purpose of arriving, if possible, at some conclusion which they would be prepared to recommend to the Dominion for acceptance, was acted upon.

During the deliberation of the Provincial representatives the claim of British Columbia was discussed as fully and as freely as were the claims of the Prairie Provinces, and, as far as we could judge from the tenor of the discussion which took place, the claim of British Columbia was favourably considered by the Provincial representatives. Certainly, so far as we are aware, no objections were made to the validity of British Columbia's claim.

As we understood the situation, the claims of all four of the Western Provinces were acceptable to the Provincial representatives. A difference of opinion arose amongst the Provincial representatives as to whether the granting of the claims of the Prairie Provinces would, or would not, entitle the Eastern Provinces to an increased subsidy allowance.

The position of British Columbia on this question is that if the granting of the claims of the Western Provinces creates or causes an inequity of treatment as between any of the Provinces, then the amount of such inequity should be ascertained and adjusted by the Dominion Government.

We were very much discouraged when, upon attempting to place British Columbia's position before the general Conference, the Hon. the Minister of the Interior again raised the objection that, as British Columbia's claim was not upon the list of subjects prepared by the Dominion for consideration, therefore the said claim could not be considered. Should the position taken by the Honourable the Minister of the Interior be upheld by this Conference, we shall certainly feel that we have been very unfairly treated.

We believe that it is the desire of this Conference that the claim of British Columbia be dealt with upon its merits, and at the same time as the claims of the Prairie Provinces are dealt with, and we so request.

If the Dominion Government is not already satisfied of the right and justice of the claim of British Columbia, we hope that we may be given the opportunity to support our claim by reason and evidence much more fully than has been possible during the deliberations of this Conference.

Respectfully submitted.

(Sgd.) JOHN OLIVER,
Prime Minister of British Columbia.

(Sgd.) T. D. PATTULLO,
Minister of Lands, British Columbia.

LETTER TO SIR W. T. WHITE FROM HON. JOHN OLIVER.

December 23rd, 1918.

Sir W. T. White,
Acting-Premier, Ottawa, Ont.

DEAR SIR,—Since returning to British Columbia from the Ottawa Conference the question of caring for the returned soldier has become more acute, and, whilst the Conference undoubtedly did much towards arriving at a better understanding, yet I strongly am impressed with the fact that we have not yet got down to a working basis. As you are aware, none of the decisions of the Conference were recorded in writing, and although the British Columbia delegates came away from the Conference with (to them) a very clear conception of what was agreed upon at the Conference, yet at conferences of this kind, where conclusions are not reduced to writing, there are apt to be differences of conception as to what understanding really was arrived at. If you will refer to my letter of the 14th addressed to the Hon. the Minister of the Interior—a copy of which was forwarded to you—you will see what British Columbia already has done, and, as our Legislature will meet in about a month's time, it is advisable that any possibility of error in preparing any necessary legislation should be removed.

Our conception of the conclusions of the Conference, as far as the same affect British Columbia, are as follows:—

(1.) That the Province would exercise its constitutional powers (to the extent of expropriation if necessary) in making suitable lands available for soldier settlement purposes:

(2.) That the Dominion Government would advance to the Province such moneys as might be necessary to make lands for soldier settlement available:

(3.) That the powers of the Soldier Settlement Board would be enlarged to enable them to purchase lands suitable and necessary for soldier settlement from either private persons or the Crown in the right of the Province:

(4.) That Federal aid to soldier settlers only would be made through the medium of the Soldier Settlement Board:

(5.) That the Federal Government desired that there should be no duplication of effort or administration in respect to soldier land settlement:

(6.) That the duty of the re-establishment of returned soldiers in civil life pertains to the Federal Government:

(7.) That the Federal Government desires the assistance and co-operation of the Provincial Governments in the civil re-establishment of returned soldiers in civil life:

(8.) That the Federal Government will designate to the Province the manner and extent of the co-operation desired:

(9.) That the Federal Government is desirous that the Province shall establish, maintain, and operate a Province-wide system of Labour Bureaus, one-half the cost of which will be borne by the Federal Government:

(10.) That the Federal Government will provide vocational training to the extent necessary for the future welfare of those returned soldiers who may be in need of the same:

(11.) That the Federal Government will loan money to the Province for the purpose of providing suitable housing accommodation:

(12.) That the Federal Government will undertake the immediate construction of necessary public works so as to prevent unemployment on any large scale:

(13.) That the Federal Government will advance loans of money to the Province so as to enable the Province to construct necessary public works with a view to preventing any large amount of unemployment.

I would urge that the Province be advised at once of the extent and manner in which Provincial co-operation is desired.

I very strongly am of the opinion that the scale of pensions should be much more liberal than they are at present, and there should be only a small margin of difference as between the private and the officer, and that, whilst a minimum pension should be fixed, the pension actually paid should actually increase in proportion as the cost of living varies above normal.

I also am very strongly of the opinion that the Federal Government should provide for the suitable housing of returned soldiers and their dependents, especially those who are suffering from any degree of disability.

I want to impress upon you in the strongest possible manner that returned soldiers should not be discharged until employment is available for them, and that in each centre of population there should be a house of refuge for returned men out of employment.

I know that there is a feeling of uneasiness existing here as to what may happen should there be any large number of unemployed engaged in demonstration; from the latter to riots and destruction is only a short step.

We constantly are being asked the following questions, and we would like you to advise us thereon:—

(*a.*) Will the Federal Government pay the cost of transporting the soldier settler and his family to the land?

(*b.*) Will the Federal Government make the soldier settler a living allowance for himself and family until he otherwise can become self-supporting?

(*c.*) Will the Federal Government make the returned soldier a living allowance until employment is secured?

(*d.*) **Will the Federal Government assist the returned soldier in—**

Furnishing home;
Live stock for farm;
Tools for his trade;
Relief re mortgages falling due;
Personal equipment;
Professional expenses of students?

(*e.*) For what length of time will the Dominion bear one-half the cost of Labour Bureaus?

Please correct any misconceptions in this letter and reply at an early date.

Yours truly,

JOHN OLIVER.

LETTER FROM SIR W. T. WHITE TO HON. JOHN OLIVER.

OTTAWA, December 31st, 1918.

Hon. John Oliver,
Prime Minister of British Columbia, Victoria, B.C.

DEAR MR. OLIVER,—I beg to acknowledge receipt of your letter of 23rd instant with reference to the subjects discussed at the recent Provincial Conference. I have asked Honourable Mr. Calder, Chairman of the Repatriation Committee of the Cabinet, to write you fully with regard to items numbered 1 to 10 in your communication. He is absent from the Capital for a few days, but will upon his return take the matter up promptly.

With regard to item No. 11, I have already forwarded you a copy of an Order in Council setting out the terms and conditions upon which the Dominion Government will loan money to the several Provincial Governments for the purpose of promoting better housing conditions.

With regard to item No. 12, the Dominion Government has already given attention to the question of continuing essential public works the completion of which was interrupted by the war.

With regard to item No. 13, it does not appear to me, in view of the favourable financial conditions now prevailing, that it will be necessary for the Dominion Government to make loans to any Provincial Government to assist in the construction of necessary Provincial public works. Should it become clearly necessary for a Provincial Government to seek assistance in this regard, we shall be glad, upon request, to take the matter up with them.

I note your remarks as to pensions and the discharge of returned soldiers. You have probably seen by the press the announcement of the Government's policy providing gratuities to discharged members of the Canadian Expeditionary Force which should maintain them until reabsorbed into civil life and occupation.

With kind regards and all good wishes for the New Year, believe me,

Yours faithfully,
W. T. WHITE.

LETTER FROM HON. J. A. CALDER TO HON. JOHN OLIVER.

OTTAWA, ONT., January 8th, 1919.

Hon. John Oliver,
Premier, Victoria, B.C.

DEAR MR. OLIVER,—Your letter of December 23rd, addressed to Sir Thomas White, has been transmitted to me with a request that I should write you fully regarding your statement of the conclusions reached by the Interprovincial Conference recently held at Ottawa, more particularly in connection with the first ten items mentioned in your letter.

As regards the problem of soldier settlement, you have in the main stated correctly the conclusions reached. As it is proposed that privately owned lands should be made available for returned men, each Province should take authority by legislation to secure these lands by expropriation, or otherwise, for the Soldier Settlement Board. It is not contemplated that the power of expropriation will have to be used to any extent. The probabilities are the Soldier Settlement Board in each Province will be able to purchase from private owners such lands as may be required. In all cases where the Board uses Provincial machinery to purchase or acquire land the Federal Government will place at the disposal of the Board such moneys as may be necessary to reimburse the Provinces.

From the discussions held at Ottawa at the time of the Conference it would appear desirable that the powers of the Soldier Settlement Board should be so enlarged as to enable it to deal with every phase of soldier settlement work. It has, therefore, been decided to submit to Parliament the necessary legislation for this purpose. **The feeling here is that but one administrative body should be established. Duplication of machinery would lead only to confusion. The Provinces, therefore, will only be expected to make provision for acquiring privately owned lands, as intimated above.** I am assuming, of course, that a definite understanding has already been reached by the Board with your Province as regards the use of Crown lands for soldier settlement purposes.

With reference to the general question of the repatriation of the returned soldier, I would judge from your statement that you appear to be of the view that the solution of this problem rests entirely at the door of the Federal Government. While the Federal Government recognizes its full responsibility as regards the returned soldier who is physically or mentally incapacitated, the problem of re-establishing in civil life the returned man who is in normal condition is one that requires the combined efforts not only of all the Governments in Canada, but of all the people as well. For the purpose of dealing with one side of this question, the conclusion was reached at the Conference that, so far as employment is concerned, the work should be centred in Labour Bureaus to be established by the Provinces. Some thirty or more of these are now in operation. Doubtless you have obtained through the Minister of Labour full details as to the assistance to be given by the Dominion Government. It has been agreed that Ottawa shall bear one-half the expense entailed in the establishment and maintenance of these offices. As to repatriation work generally, the Dominion Government, through the Repatriation Committee

of the Cabinet, stands prepared to assume responsibility for organizing the nation for the task. The machinery for this purpose has already been set in motion. The co-operation of the Provincial and Municipal Governments, the Patriotic Fund, the Red Cross Society, various friendly societies, churches, and other organizations and bodies is needed and is being secured. Presently we expect to have, from ocean to ocean, an organization that should be able to grapple with the problem and render efficient service.

The Department of Returned Soldiers' Civil Re-establishment, under Sir James Lougheed, has, by Statute, been assigned the task of providing vocational training for returned men, and have been carrying on the work for months past with the co-operation of the Provinces, which have made available their various institutions that are suitable for the purpose. **It is not intended that Provincial Governments should assume any direct responsibility in this field of work.** They can, however, assist materially by permitting the use of Provincial educational and other institutions on terms to be agreed upon.

I am sure you will agree with me that the problem of repatriation that confronts us is, to say the least, a difficult one. What is needed in Canada more than anything else is a clear recognition on the part of our people that the job is one for the nation as a whole. The replacing of three or four hundred thousand soldiers in our civil life is a task that cannot be accomplished by any Government or any set of Governments. Governments can plan, organize, and assist in a large way, but unless our people generally view the problem in the right light and stand prepared to assist in every way possible, I fear there are dangers ahead. The tendency upon the part of many people to shift the entire burden from themselves and place it upon the shoulders of the Government, both Federal and Provincial, is to be deplored. As I have previously stated, Governments can and must assist in a large way, but when you get right down to the final analysis of the problem its real solution will be found to depend upon the whole-hearted, active, and sympathetic support of the Canadian people.

In case there is any further information you desire, I shall be very pleased to furnish same if it is within my power.

Yours very truly,
J. A. CALDER.

LETTER FROM HON. JOHN OLIVER TO HON. J. A. CALDER.

January 17th, 1919.

Hon. J. A. Calder,
Minister of Immigration and Colonization, Ottawa, Ont.

DEAR MR. CALDER,—I write to acknowledge receipt of your letter of the 8th inst., regarding the conclusions reached by the Interprovincial Conference at Ottawa. I thank you for the very full statement of your understanding in this matter, as this clears the question and obviates the chance for any misunderstanding.

With best wishes,

Yours truly,
JOHN OLIVER.

VICTORIA, B.C.:
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PAPERS

Presented to the House relating to the Pacific Great Eastern Railway, and consisting of: (1) Letter of Burns & Walkem dated November 15th, 1917; (2) Letter of Chief Engineer Proctor dated February 28th, 1919; (3) Letter of Chief Engineer Proctor dated June 10th, 1918; (4) List of Equipment checked up by Morrissey & Anderson as per Chief Engineer Proctor's Letter of June 10th, 1918; (5) Recapitulation of Equipment as per Sheets Nos. 1, 2, and 3.

JOHN OLIVER,
Minister of Railways.

Department of Railways,
February, 1919.

(1.)

STANDARD BANK BUILDING,
VANCOUVER, CANADA, November 15th, 1917.

Honourable John Oliver,
Minister of Railways, Victoria, B.C.

RE ATTORNEY-GENERAL VS. PACIFIC GREAT EASTERN RAILWAY, ET AL.

DEAR SIR,—In pursuance of your request to Mr. Cromie and the writer made on Monday last, that we give you a list of the assets we are prepared to turn over to the Government in consideration of a release of all obligations, we beg to state these assets are as follows:—

(*a.*) *Railroad completed and under Construction*—

Engineering	$ 830,935 00
Construction	13,690,394 00
Additional construction paid by P.G.E. Railway	63,321 00
Construction by Operating Department	441,889 00
	$15,026,540 00
Reasonable contractor's profit at 10 per cent. on construction as above	1,502,654 00
Right-of-way and station-grounds	364,011 00
Howe Sound and Northern Railway purchase	187,299 00
Use, loss, and depreciation of contractor's plant	750,000 00
	$17,830,504 00
General and executive expenses during construction	171,165 00
	$18,001,669 00

The figures given above are the actual costs when labour and material were very much lower than at present, and in order to arrive at present-day values the above figures should be increased very materially.

(*b.*) *Railroad Equipment*—

8 locomotives.
3 flat cars, Nos. 1031, 1032, 1033.
137 flat cars.
50 box cars.
3 refrigerator-cars.
10 gondolas.

5 stock-cars.
10 tank-cars.
1 caboose, C-O.
3 other cabooses.
2 wedge-ploughs.
2 snow-flanges.
1 Marion steam-shovel, No. 1777.
1 pile-driver, No. 1.
1 pile-driver, No. 2.
1 derrick, No. 1.

All other Work Equipment—

108 log-trucks.
3 gasolene motor-cars.
3 trailer coaches.
5 day-coaches.
1 combination coach.
2 baggage and mail coaches.
1 business-car.

$1,153,204 00

(*c.*) *Real Estate.*—The real estate of the Company is set out in detail in Appendix 1 to the audit of the P. Welch books made by Marwick, Mitchell, Peat & Company, copy of which you have in your possession. All this real estate has been paid for in full and is held in the name of the Pacific Great Eastern Development Company, Limited, which Company holds the lands in fee-simple, the number of each certificate of title being set out in said Appendix 1. Shortly, the real estate consists of the Squamish Townsite, the Indian Reserve at Squamish, and the foreshore, the townsite having been taken over from the Howe Sound & Northern Railway at an actual cash cost of $861,275.14. The real estate also includes valuable townsites at Cheakamus, Lillooet, and Williams Lake; at the latter place the Company owns not only the necessary townsites, but very valuable specially selected agricultural lands of a total acreage of 3,009 acres; this property includes the well-known Borland Ranch. At Swan Lake, in the Peace River District, the Company owns three sections of splendid agricultural land, specially adapted for joint terminal of the Edmonton-Dunvegan & British Columbia and Pacific Great Eastern Railways. The former road is now within a few miles of this point.

The total cost of the above land to the Company, with interest and carrying charges, amounts to $1,608,222.

In estimating the value of these lands at the present time, we do not think it should go below cost. The large amount paid for the Squamish Townsite included all the rights, franchises, etc., of the Howe Sound & Northern Railway, and if these assets had not been paid for in this way they would have been purchased and charged to construction cost. In addition, these townsites and foreshore will be of immense value as soon as the road is constructed.

The other lands of the Company, being principally agricultural lands, are worth more to-day than when purchased. For example, as soon as the railroad is constructed to Williams Lake the Company lands in that district will treble in value.

(*d.*) *Rails.*—The rails and fastenings available consist of about 8,000 tons along the line and 220,000 rails and accessories on order. The increased value of these at the present time over cost is approximately $1,150,000.

(*e.*) *Cash in Bank.*—The cash at present in the bank amounts to $277,000. The amount at the time of the P. Welch audit was $409,708, and about $50,000 has since been deposited from sales, and the difference over and above a small loss on operation has been expended in the construction of roundhouses, machine-shops, and station-houses, so that these, with the amount in the bank, leave an actual present value of approximately $459,000 not taken into account under any other heading.

(*f.*) *Sundries.*—These consist of supplies, boats, tools, plant, and office furniture, having a value of $50,000.

(*g.*) *Peace River Extension, $34,458.*—This money was usesd on surveys, rights-of-way, etc., on the Peace River Extension.

Summary.

(*a.*) Railway	$18,001,669 00
(*b.*) Equipment	1,153,204 00
(*c.*) Lands and townsites	1,608,222 00
(*d.*) Rails	1,150,000 00
(*e.*) Cash, buildings, shops, etc.	459,000 00
(*f.*) Sundries	50,000 00
(*g.*) Peace River Extension	34,458 00
	$22,456,553 00

The above figures are very reasonable and will bear the most searching scrutiny by competent appraisers; we feel that a fair appraisement would be far in excess of the figures quoted, as it is well known that the cost of this work was extremely low, so low, in fact, that the sub-contractors complained seriously. The work was done when labour and materials were cheap and by a firm of contractors who are recognized as among the most expert on the continent, as has been demonstrated by the important work entrusted to one of the members of the firm now at the Front.

If there is any further information we can give you in connection with the above figures we will be pleased to do so at any time.

Yours truly,
(Sgd.) BURNS & WALKEM.
Per KNOX WALKEM.

(2.)

DEPARTMENT OF RAILWAYS.
VICTORIA, B.C., February 28th, 1919.

RE P.G.E. SETTLEMENT.

Memo. for the Hon. the Premier and Minister of Railways.

In the Brown & Walkem letter dated November 15th, 1917, and on which all the negotiations were based, 108 logging-trucks appear in a list of equipment set forth therein.

You knew and the firm of Foley, Welch & Stewart was also aware of the fact that only three connected trucks should have appeared in this list, as the balance of the trucks was shipped off the line between April 30th, 1917, and September 9th, 1917, or two months before the offer was made.

A. F. PROCTOR,
Chief Engineer.

(3.)

DEPARTMENT OF RAILWAYS.
VICTORIA, B.C., June 10th, 1918.

Memo. to the Premier and Minister of Railways.

DEAR SIR,—The equipment as shown on sheets Nos. 1, 2, and 3, and the summary dated September 30th, 1916, and filed as Exhibit 175, before the Investigating Committee, has been checked on the ground by Messrs. Morrissey and Anderson, and found correct with the exception of the logging-trucks, all of which, except three connected, have been sold. The above-mentioned sheets and summary have been compared by me with the equipment record and found to be correct.

Yours truly,
A. F. PROCTOR,
Chief Engineer.

(Sheet No. 1.) VANCOUVER, B.C., September 30th, 1916.

EQUIPMENT OF THE P.G.E. EQUIPMENT COMPANY, LIMITED, NOW IN USE BY THE P.G.E. RAILWAY (CONSTRUCTION DEPARTMENT).

No.	Kind of Equipment.	Purchased from.	Shop or Serial No.	Invoice Cost.	Duty.	Freight.	Insp.	Sundry.	Total, ea.	Total.
1	Steam-locomotive	Howe Sound & Northern Rly	1	$6,500 00						$6,500 00
1	"	" "	2	6,500 00						6,500 00
1	"	Dav. Locomotive Works	3	9,200 00	$3,222 50	$1,186 70		$269 74		13,878 94
1	"	Montreal Locomotive Works	51	22,520 00		2,221 05	$200 00	207 31		25,148 36
1	"	" "	52	22,520 00		2,221 05	200 00	519 22		25,460 27
1	"	Canadian Locomotive Works	53	22,597 44			206 25	75 00		22,878 69
1	"	" "	54	22,597 45			206 25	75 00		22,878 70
1	"	" "	55	22,597 44			206 25	75 00		22,878 69
1	"	" "	56	22,597 45			206 25	75 00		22,878 70
9	"			$157,629 78	$3,222 50	$5,628 80	$1,225 00	$1,296 27		$169,002 35
4	Wood under-frame 80,000 cap. box	Seattle Car & Foundry Co	3001-3-5-6	$1,273 00			$11 67		$1,284 67	$5,138 68
2	" " "	" "	3002-3004	1,273 00			11 66		1,284 66	2,569 32
3	Steel " "	National Steel Car Co	3501-4-7	1,203 00			5 00	$18 40	1,226 40	3,679 20
7	" " "	" "	3502-3-5-6-8-9-10	1,203 00	(less $7.35 dis.)		5 00	75	1,201 40	8,409 80
1	" " "	" "	3511	1,203 00	"		5 00	1 75	1,202 40	1,202 40
11	" " "	" "	3512-13-14-15-16-17-18-19-20-21-31	1,203 00	"		5 00		1,200 65	13,207 15
2	" " "	" "	3522-3523	1,203 00	"		5 00	85	1,201 50	2,403 00
8	" " "	" "	3524-5-6-7-37-8-42-3	1,203 00	"		5 00	86	1,201 51	9,612 08
7	" " "	" "	3528-9-30-32-3-4-5	1,203 00	"		5 00	59	1,201 24	8,408 68
1	" " "	" "	3531	1,203 00	"		$25 00	5 00	59	1,226 24
3	" " "	" "	3536-40-44	1,203 00	"		5 00	58	1,201 23	3,603 69
1	" " "	" "	3539	1,203 00	"		5 00			1,200 65
50									Aver., ea.	$1,213 22	$60,660 89
8	Wood under-frame 80,000 cap. flat	Seattle Car & Foundry Co	1001-1008	$1,075 00			$7 00		$1,082 00	$8,656 00
2	" " "	" "	1009-1010	1,075 00			7 00		1,082 00	2,164 00
5	" " "	" "	1011-1015	1,158 00			4 00	$43 10	1,205 10	6,025 50
1	" " "	" "	1016	1,158 00			4 00	43 09		1,205 09
1	" " "	" "	1017	1,158 00			4 00	55 76		1,217 76
13	" " "	" "	1018-1030	1,158 00			4 00		1,162 00	15,106 00
3	" " "	Howe Sound & Northern Rly	1031-1033	800 00					800 00	2,400 00
4	Steel " "	National Steel Car Co	1034-6-7-8	993 00	(less $7.35 dis.)	$110 16	5 00	25 82	1,126 63	4,506 52
1	" " "	" "	1035	993 00	"		5 00	82		991 47
10	" " "	" "	1039-1048	993 00	"	110 16	5 00	25 69	1,126 50	11,265 00
13	" " "	" "	1049-50-1-2-3-62-3-4-8-9-71-2-3	993 00	"	110 16	5 00	25 00	1,125 81	14,635 53
2	" " "	" "	1054-1093	993 00	"	110 16	5 00	25 68	1,126 49	2,252 98
1	" " "	" "	1055	993 00	"	111 88	5 00	68		1,103 21
2	" " "	" "	1056-1058	993 00	"		5 00	68	991 33	1,982 66
1	" " "	" "	1057	993 00	"	111 90	5 00	68		1,103 23
7	" " "	" "	1059-60-1-5-6-7-70	993 00	"	110 16	5 00		1,100 81	7,705 67
19	" " "	" "	1074-1092	993 00	"	110 16	5 00	25 67	1,126 48	21,403 12
2	" " "	" "	1094-1095	993 00	"	19 88	5 00	77	1,011 30	2,022 60
3	" " "	" "	1096-7-8	993 00	"	19 88	5 00	76	1,011 29	3,033 87
2	" " "	" "	1099-1100	993 00	"	19 88	5 00	25 76	1,036 29	2,072 58
10	" " "	Canadian Car and Foundry Co	1101-2-5-6-7-8-9-10-11-12	960 00	(less $7.20 dis.)	24 88	5 00		982 68	9,826 80
2	" " "	" " "	1103-4	960 00	(less 7.01 dis.)	24 88	5 00		982 87	1,965 74
28	" " "	" " "	1113-1140	960 00	(less 7.20 dis.)	27 88	5 00		985 68	27,599 04
140									Aver., ea.	$1,073 17	$150,244 37

(Sheet No. 2.)

Equipment of the P.G.E. Equipment Company, Limited, now in Use by the P.G.E. Railway (Construction Department).

No.	Kind of Equipment.	Purchased from.	Shop or Serial No.	Invoice Cost.	Duty.	Freight.	Insp.	Sundry.	Total, each.	Total.
	Refrigerators.									
1	80,000 cap steel under-frame, 36 feet	National Steel Car Co.	801	$2,297 00	(less $7.35 dis.)		$100 00	$26 86		$2,416 51
2	" "	" "	802-3	2,297 00	"		100 00	26 87	$2,416 52	4,833 04
3									$2,416 52	$7,249 55
1	100,000 cap. all-steel gondola, 40 feet	National Steel Car Co.	901	$1,575 00	(less $9.37 dis.)		$18 00			$ 1,583 63
1	" "	" "	902	1,575 00	"		18 00	$ 148		1,585 11
1	" "	" "	903	1,575 00	(less 9.38 dis.)	$ 70 12	18 00	1 49		1,655 23
7	" "	" "	904-910	1,575 00	"	110 16	18 00	25 00	$1,718 78	12,031 46
10									$1,685 54	$16,855 43
1	60,000 cap. steel under-frame stock-cars, 36 ft.	National Steel Car Co.	501	$1,210 00	(less $7.20 dis.)	$165 24	$40 00			$1,408 04
4	" "	" "	502-6	1,210 00	"	165 24	40 00	$25 00	$1,433 04	5,732 16
5									$1,428 04	$7,140 20
2	8,000-gal. steel tank cars, second-hand	Erie Car Works.	x-51-52	$ 685 00	$240 50	$146 28	$18 24		$1,090 02	$2,180 04
4	10,000-gal. steel tank cars, second-hand	American Car and Foundry Co.	x-53-56	1,280 00	384 25	157 16	10 04		1,831 45	7,325 80
3	10,000-gal. steel.	" "	x-57-8-9.	1,230 00	370 90	156 62	6 51		1,764 03	5,292 09
1	"	" "	x-60	1,230 00	370 80	156 62	6 51		1,763 93	1,763 93
10									$1,656 18	$16,561 86
1	Caboose, second-hand	Howe Sound & Northern Railway	C-0	$ 900 00						$ 900 00
3	Steel under-frame 8 wheels, 30 feet	National Steel Car Co.	C-1-2-3	1,995 00	(less $7.35 dis.)	$165 24	$20 00	$25 00	$2,107 89	6,593 67
										$7,493 67
1	Second-hand Marion steam-shovel, Model 60.	J. W. Stewart, Abbotsford.	1777	$ 9,000 00	$195 45	$ 341 00			$1,560 70	$11,097 13
1	Second-hand 70-ton Bucyrus	F. B., W. & S., Glacier, B.C.	1652	13,022 54		1,458 56		407 56		14,888 66
1	Second-hand Jordon spreader	O. F. Jordon Co.	303	5,040 00	1,387 00	233 61		110 91		6,771 52
1	Lidgerwood unloader, second-hand	F. H. Hopkins, Montreal		6,216 00		997 50		343 30		7,556 80
1	Marion centre-ballast plough	" "		875 00		397 50		4 45		1,276 95
1	Marion log-loader, second-hand	F. Bros. & Northern Const'n Co.		3,500 00		449 00		137 48		4,086 48
1	Pile-driver, second-hand	J. W. Stewart, Abbotsford.	1	2,000 00				250 02		2,250 02
1	" "	" "	2	2,000 00 950 00				1,002 98		3,952 98
1	Second-hand steam-hammer									
1	Russell snow-plough	Russell Car & Snow-plough Co.	1	(less $8.31 dis.) 4,900 00	1,477 50	816 20	$49 19	75 00		7,309 58
1	Cassidy rail-curver, second-hand	Holden Co		1,200 00			15 00			1,215 00
1	Loco. crane, second-hand	F. Bros. & Northern Const'n Co.	(Dep.)	6,500 00	(less 166.67 dis.)	2,265 20		726 73		9,326 26
1	Cassidy rail-curver, second-hand	Holden Co		12,00 00		104 00		6 40		1,310 40
1	Derrick	J. W. Stewart, Abbotsford	1	2,500 00 2,596 03	126.12			34 55		5,256 70 5,410 59
1	Tracklayer	F. Bros. & Northern Const'n Co.		4,247 00	(less 247.00 Dp.)	965 39		445 20		
5	Camp cars, second-hand	Johnson & Carey	100-104	369 20	110 76	158 30	8 25	25 00	$671 51	3,357 55
6	"	"	105-110	369 25	110 75	158 30	8 25	25 00	671 55	4,029 30
1	"	"	111	369 25	110 75	158 30	8 20	31 88		678 38
1	"	"	112	369 25	110 75	158 30	8 20	25 00		671 50
	Work equipment carried forward									$90,444 80

(Sheet No. 3.)

EQUIPMENT OF THE P.G.E. EQUIPMENT COMPANY, LIMITED, NOW IN USE BY THE P.G.E. RAILWAY (CONSTRUCTION DEPARTMENT).

No.	Kind of Equipment.	Purchased from.	Shop or Sereal No.	Invoice Cost.	Duty.	Freight.	Insp.	Sundry.	Total, each.	Total.
	Work equipment brought forward									$90,444 80
2	Second-hand Hart convertible	F. H. Hopkins & Co	131-39	$1,050 00		$121 03	$18 35	$13 90	$1,203 28	2,406 56
1	" "	"	137	1,050 00		121 03	18 35	19 40	1,208 78	1,208 78
2	" "	"	140-141	1,050 00		121 03	18 35	5 50	1,194 88	2,389 76
6	" "	"	63-166-142-150-54-160	1,050 00		121 03	18 30	5 50	1,194 83	7,168 98
2	" "	"	152-153	1,050 00		121 03	18 30	19 39	1,209 72	2,417 44
2	" "	"	173-184	1,050 00		121 02	18 30	19 39	1,208 71	2,417 42
1	" "	"	178	1,050 00		121 02	18 30	5 50		1,194 82
1	"	"	195	1,050 00		121 02	18 30	13 89		1,203 21
										$110,851 77
17	Second-hand log-trucks	Howe Sound & Northern Railway	Unnumbered	$375 00					$375 00	$ 6,375 00
3	" " (con.)	" "	109-11-13	750 00					750 00	2,250 00
88	" "	" "	201 to 288	375 00					375 00	33,000 00
108										$41,625 00
1	Gasolene-motor	Hall-Scott Motor	101	$16,265 15	$5,688 50	$568 44	$181 55	$244 82		$22,948 46
	Rebuilt motor	"	101	12,800 00	5,442 00	876 29	206 67	20 25	$19,345 21	
	Less insurance on first 101 *								10,977 08	
										8,368 13
1	Gasolene-motor	Hall-Scott	102	16,265 15	5,688 50	569 37	181 55	248 67		22,953 24
1	"	"	103	28,567 32			260 30	66 70		28,894 32
1	Trailer coach	Canadian Car & Foundry Co	111	8,000 00	(less 29.40 dis.)		138 12	20 71		8,129 43
1	"	" "	112	8,000 00	"		138 13	20 72		8,129 45
1	"	" "	113	8,000 00	"		138 13	20 72		8,129 45
1	Second-hand day passenger-coach	E. H. Wilson & Co	1	1,928 20	694 50	304 56	36 18	33 50		2,896 94
1	" "	"	2	2,703 20	811 90	304 56	32 85	6 60		3,859 11
2	" "	"	3-4	2,703 20	811 65	304 56	32 85	6 61	3,858 87	7,717 74
1	" "	"	5†	1,430 00	536 68 226 87	290 46	36 18	34 51		2,554 70
1	" "	"	5	1,653 20	880 60	304 56	66 72	110 90		3,015 98
1	Second-hand combination	"	10	2,228 20	670 65	290 40	97 85	13 17		3,300 27
2	Baggage and mail	"	51-52	1,753 20	657 37	308 99	84 43	2 75	2,806 74	5,613 48
1	Business car, "Lillooet," second-hand	Central Locomotive & Car Works	A-1	7,025 00	2,109 00	265 68	40 00	130 60		9,570 28
3	Gasolene-motors									
3	Trailer coaches									
5	Day-coaches									$146,080 98
1	Combination									
2	Baggage and mail									
1	Business car									
15	Second-hand, 12 Yard-Wester side-dump, air.	12 from F.B., W. & S., Bear Creek; 3 from Cambie, B.C.	29-34-39-40-18-20-22-26-29-1-2-3-6-7-16							
1	Second-hand locomotive, Vulcan	P. Welch, Prince George, B.C.	P. Welch, No. 52							

* First motor-car No. 101 was wrecked and insurance allowed and collected to an amount of $10,977.08.
† This coach destroyed by fire.

RECAPITULATION OF EQUIPMENT AS SHOWN ON SHEETS NOS. 1, 2, AND 3.

No.	Kind of Equipment.	DEBIT. Amount.	DEBIT. Net Amount.	DEBIT. P.G.E. Equip. Co.	CREDIT. P.G.E. Ry. Co.	CREDIT. P.G.E. Dev. Co.	CREDIT. Abbotsford Outfit.
9	Locomotives	$169,002 35					
	Less one locomotive, No. 1, scrapped	6,500 00					
			$162,502 35	$162,502 35	$156,002 35	$ 6,500 00	
3	Flat cars, Nos. 1031, 1032, 1033	$ 2,400 00		2,400 00		2,400 00	
137	Flat cars, remainder on sheet No. 1	147,844 37					
			150,244 37	147,844 37	147,844 37		
50	Box cars		60,660 89	60,660 89	60,660 89		
3	Refrigerator-cars		7,249 55	7,249 55	7,249 55		
10	Gondolas		16,855 43	16,855 43	16,855 43		
5	Stock-cars		7,140 20	7,140 20	7,140 20		
10	Tank cars		16,561 86	16,561 86	16,561 86		
1	Caboose, C-O	$900 00		900 00		900 00	
3	Other cabooses, sheet No. 2	6,593 67					
			7,493 67	6,593 67	6,593 67		
	Work Equipment.						
1	Marion steam-shovel, No. 1777	$ 11,097 13		11,097 13	2,097 13		$9,000 00
1	Pile-driver, No. 1	2,250 02		2,250 02	250 02		2,000 00
1	Pile-driver, No. 2	3,952 98		3,952 98	1,952 98		2,000 00
1	Derrick, No. 1	5,256 70		5,256 70	2,756 70		2,500 00
	All other work equipment (sheets 1 and 2)	88,294 94					
			110,851 77	88,294 94	88,294 94		
108	Log-trucks, sheet No. 3		41,625 00	41,625 00		41,625 00	
3	Gasolene motor-cars	$74,796 02		74,796 02	74,796 02		
3	Trailer coaches	24,388 33		24,388 33	24,388 33		
5	Day-coaches	17,489 77		17,489 77	17,489 77		
1	Combination coach	3,300 27		3,300 27	3,300 27		
2	Baggage and mail coaches	5,613 48		5,613 48	5,613 48		
1	Business car	9,570 28					
			135,158 15	9,570 28	9,570 28		
	Loss	$135,158 15					
	Loss of motor 101	8,368 13					
	Loss of coach No. 5	2,554 70					
	See sheet No. 3	$146,080 98					
	Totals		$716,343 24	$716,343 24	$649,418 24	$51,425 00	$15,500 00

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

PACIFIC GREAT EASTERN RAILWAY.

Balance-sheet and Statement of Expenditure of the Pacific Great Eastern Railway Company.

Presented to the Legislature on March 5th, 1919, by the Hon. the Premier.

EXTENDED BALANCE-SHEET AS AT MAY 31ST, 1918.

ASSETS.

Main line, value at cost to date, per attached statement		$25,637,377 04
Peace River Extension, value at cost to date, per attached statement		34,434 01
Premiums and discounts on securities sold	$ 470,687 29	
Premiums, discounts, and expenses on Provincial loan	74,928 93	
		545,616 22
Foley, Welch & Stewart's grant and guarantees		24,960,000 00
Securities pledged with Union Bank of Canada, Ottawa (par)		5,925,195 00
Accounts collectable		5,746 96
Advances repayable		100 00
Cash—		
At credit, Minister of Finance, B.C., Account No. 1 $260,638 41		
At credit, Minister of Finance, B.C., Account No. 2 800,000 00		
	$ 1,060,638 41	
Overdraft, Current Account, Union Bank of Canada	681 21	
		1,059,957 20
		$58,168,426 43

LIABILITIES.

Capital stock issued		$25,000,000 00
Bonds issued—		
First Mortgage 4½ per cent. Guaranteed Debenture Stock	$16,800,000 00	
4½ per cent. Guaranteed Debenture Stock, second charge	3,360,000 00	
		20,160,000 00
Interest earned on bank balances		262,401 89
Accounts payable—		
Union Bank of Canada, Nos. 1 and 2 (loan)	$ 4,800,000 00	
P.G.E. Dev. Co., Ltd., No. 3 $858,073 00		
P.G.E. Dev. Co., Ltd., Agreement, Feb. 1st, 1917 32,400 00		
	890,473 00	
P. Welch, Nos. 4, 5, and 6	293,674 78	
		5,984,147 78
Audited vouchers and pay-rolls		29,346 33
Brown, Shipley & Co., account to December 31st, 1917		7,584 27
Province of British Columbia—		
Loan Account (chapter 38, 1916, Statutes of B.C.)	$ 2,122,474 13	
Interest paid under guarantees	1,927,928 34	
		4,050,402 47
Carried forward		$55,493,882 74

LIABILITIES—*Concluded.*

Brought forward		$55,493,882 74
P. Welch—		
Retentions from estimates	$ 1,647,563 02	
Interest paid on Union Bank of Canada loan	427,595 29	
Cash loaned to Company	17,591 01	
		2,092,749 32
Interest accruing payable—		
On debenture stock issued	$ 240,212 33	
On Union Bank of Canada loan	144,000 00	
On Province of B.C. loan	20,965 89	
On Dev. Co. Agreement, February 1st, 1917, and B./P. No. 3 (to April 22nd, inc.)	151,370 75	
On P. Welch, B./P. Nos. 4, 5, and 6 (to April 22nd, inc.)	24,185 40	
		580,734 37
Operating Department		1,060 00
		$58,168,426 43

Certified correct.

R. D. THOMAS,
Secretary-Treasurer.

Victoria, B.C., June 27th, 1918.

STATEMENT OF EXPENDITURE DURING MARCH, APRIL, AND MAY, 1918, AND TOTAL TO MAY 31ST, 1918.

MAIN LINE.

	March-May.	Total to May 31st, 1918.
Location	.....	$ 196,943 85
Engineering	$ 621 01	658,021 27
Right-of-way and station-grounds	200 06	1,326,026 52
Grading	.....	12,371,232 40
Tunnels	.....	296,751 04
Bridges	.....	2,877,188 72
Ties	.....	452,234 23
Rails	.....	1,326,096 31
Frogs and switches	.....	25,463 37
Track-fastenings and other material	.....	316,285 53
Ballast	.....	132,783 66
Tracklaying and surfacing	.....	299,932 49
Fencing	.....	16,135 82
Crossings and signs	.....	4,078 34
Telegraph and telephone lines	.....	62,552 00
Station buildings and fixtures	.....	16,346 91
Shops, engine-houses, and turntables	.....	37,759 22
Water-stations	.....	35,508 45
Fuel-stations	.....	31,590 66
Miscellaneous structures	.....	12,971 06
Operating expenses and earnings	10 00	22 00
Howe Sound and Northern Section	.....	187,299 86
Law expense	.....	6,365 85
Stationery and printing	33 45	9,741 33
Insurance	.....	784 70
Interest, commission, and exchange	267,828 04	4,729,089 89
Other expenditures	3,736 68	208,215 56
Totals	$272,409 24	$25,637,377 04

Peace River Extension.

	March-May.	Total to May 31st, 1918.
Location	.....	$ 32,156 23
Engineering	.....	1,446 43
Right-of-way and station-grounds	.....	639 50
Stationery and printing	.....	16 33
Other expenditures	.....	175 52
Total	.....	$ 34,434 01

Certified correct.

R. D. Thomas,
Secretary-Treasurer.

Victoria, B.C., June 27th, 1918.

VICTORIA, B.C.:
Printed by William H. Cullin, Printer to the King's Most Excellent Majesty,
1919.

SECOND ANNUAL REPORT

OF

THE LAND SETTLEMENT BOARD

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE YEAR ENDING

DECEMBER 31ST, 1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

To His Honour Sir Frank Stillman Barnard, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

May it please Your Honour:

The undersigned has the honour to present the Second Annual Report of the Land Settlement Board for the year ending December 31st, 1918.

All of which is respectfully submitted.

E. D. BARROW,
Minister of Agriculture.

Victoria, B.C., January 31st, 1919.

LAND SETTLEMENT BOARD OF BRITISH COLUMBIA,

VICTORIA, B.C., January 31st, 1919.

The Honourable E. D. Bárrow,

Minister of Agriculture, Victoria, B.C.

SIR,—I have the honour to transmit herewith the Second Annual Report of the Land Settlement Board of British Columbia for the year ending December 31st, 1918.

I have the honour to be,

Sir,

Your obedient servant,

MAXWELL SMITH,

Chairman.

Land Settlement Board of British Columbia.

Pursuant to the policy outlined in our Annual Report for the year ending December 31st, 1917, the Land Settlement Board has very materially reduced the volume of the money-loaning business during the past year, as well as insisting that a larger percentage of the amount loaned be devoted to improvements to the security offered, thereby "promoting increased agricultural production."

Land settlement and development has occupied the major portion of the Board's attention the past twelve months, with the result that a great volume of valuable data is now on hand consequent upon personal investigation of numerous and extensive areas of land by the Directors throughout the Province. Special attention has been given to the unoccupied Crown-granted lands situated convenient to transportation and markets, and that which has been acquired is being offered for sale on easy terms of payment to *bona-fide* agricultural settlers who are qualified and willing to assume the responsibilities of Canadian citizenship.

The following are some of the important recommendations of the Board submitted for the approval of His Honour the Lieutenant-Governor in Council:—

(1.) The resale of 69,991 acres of pasture land north of Hudson Hope, B.C., to the Peace River Land Company, Limited, for $200,000, on conditions of $30,000 being expended in improvements on the property before June 30th, 1921, and maintaining stock on the lands up to its feeding capacity, at least until July 1st, 1923, and until such time thereafter as the full purchase price, with interest and taxes, have been paid. January 15th, 1918.

(2.) The thorough investigation into and survey of the Kootenay Flats near Creston, B.C., to ascertain the feasibility of that reclamation project. January 30th, 1918.

(3.) The securing of feasibility report on the Cherry Creek irrigation project, affecting approximately 8,000 acres. January 30th, 1918.

(4.) The purchase of 482 head of cattle for resale to the farmers of the Bulkley Valley at a cost of $23,579. February 1st, 1918.

(5.) The purchase of 5,850 acres of land on Pitt Meadows from the Pitt Meadows Land Company, Limited, at $55 per acre, and 1,050 acres adjoining from the Pitt River Farm and Construction Company, Limited, at $75 per acre. February 21st, 1918.

(6.) The constitution of the Cameron Drainage District to reclaim approximately 400 acres near Nanaimo, B.C. March 7th, 1918.

(7.) The purchase of the Coldstream Estate and the White Valley irrigation system, including all live stock, implements, and general equipment, approximately 13,000 acres, at a cost of $900,000, payable in twenty-year 5-per-cent. bonds. April 17th, 1918.

(8.) The expenditure of approximately $10,000 in securing a reliable engineering report on the feasibility of reclaiming Sumas Lake and adjacent lands. April 29th, 1918.

(9.) The establishment of Settlement Area No. 1, 14,500 acres, near Telkwa, B.C., and Settlement Area No. 2, 35,000 acres, near Vanderhoof, B.C., on the Grand Trunk Pacific Railway. July 2nd, 1918.

(10.) The purchase of 14,000 acres of logged-off lands in the Comox Valley from the Canadian Western Lumber Company at $5 per acre. December 18th, 1918. Option secured accordingly, December 28th, 1918.

(11.) The establishment of Settlement Area No. 3, near Fernie, containing 1,500 acres. December 19th, 1918.

(12.) The desirability of proceeding with the Cranbrook drainage scheme at Cranbrook to reclaim approximately 400 acres. December 20th, 1918.

Of the above-mentioned projects, six have been approved—viz., No. 3, No. 4, No. 6, No. 8, No. 9, and No. 11—and proceeded with accordingly.

OPERATIONS OF LAND SETTLEMENT BOARD TO DECEMBER 31ST, 1918.

1. Number of Agricultural Credit Commission applications pending and unappraised at December 31st, 1917, 109, value		$190,900 00
Above were dealt with as follows:—		
60 rejected or withdrawn	$115,150 00	
12 granted for $23,150. Applied for	28,350 00	
11 action pending	25,250 00	
26 unappraised	22,150 00	
109		$190,900 00
Status of Agricultural Credit Commission loans—		
490 loans granted prior to 1918 for		$941,950 00
19 loans granted during 1918 for		31,300 00
509 Total loans granted		$973,250 00
106 loans cancelled prior to 1918		$153,400 00
16 loans cancelled during 1918		41,000 00
122 Total loans cancelled		$194,400 00
509 loans granted		$973,250 00
122 loans cancelled		194,400 00
387 Net number of loans		$778,850 00
5 loans have been paid off		5,500 00
382 loans in force		$773,350 00
There are 7 loans where the mortgage moneys have not yet been advanced, amount granted		$ 7,650 00
Balance of Loans Account at December 31st made up as follows:—		741,417 45
Principal	$735,708 93	
Interest due	5,708 52	
During 1918 payments were received on account of loans as follows:—		
Interest paid	$ 43,075 97	
Principal paid	26,974 66	
Total	$ 70,050 63	

Statement of revenue and expenditure and balance-sheet are submitted herewith.

2. There were Land Settlement Board applications pending and unappraised at December 31st, 1917, 44, value		$ 67,130 00
These were dealt with as follows:—		
20 rejected or withdrawn	$ 40,630 00	
18 granted for $17,750. Applied for	22,050 00	
3 pending	2,600 00	
3 unappraised	1,850 00	
44		$ 67,130 00
Applications received during the year 1918, 145, value		$366,150 00

The above were dealt with as follows:—

66	granted, $165,150.		
	Applied for	$197,950 00	
52	rejected or withdrawn	121,700 00	
6	pending	13,500 00	
21	unappraised	33,000 00	
			$366,150 00
145			

Status of Land Settlement Board loans—

Loans granted in 1918—		
96	loans granted as above	$206,050 00
6	loans reconsidered	4,200 00
102	Total	$210,250 00
Loans cancelled in 1918—		
23,	amount	$29,250 00
Total Land Settlement Board loans granted—		
246,	amount	$511,600 00
Less 29	loans cancelled	42,750 00
217	loans in force	$468,850 00
	Amount still due to borrowers	$107,425 14

Statement of revenue and expenditure and balance-sheet are submitted herewith.

In analysis of the statement of revenue and expenditure for the year 1918, due consideration should be given to the fact that a good deal of time was spent and expense incurred by the Directors in the investigation of numerous propositions which may properly be termed land-settlement projects. Many of these were found to be not feasible at the present time, and hence the expense incurred necessarily augments the outlay as shown in the statement as submitted.

There is another factor in the varied operations of the Board in relation to the Government of the Province which to a considerable degree offsets the direct expense incurred, and that is the greatly increased revenue derived through the payment of taxes, which in many cases were several years in arrears. This applies not only to taxes on land in the settlement areas, but also to properties throughout the Province on which loans have been advanced.

Too great emphasis cannot be laid on the very great assistance which has been rendered the farmers through the loans advanced. During the year approximately $280,000 has been advanced for purposes of making improvements, buying stock, etc., in addition to the $23,579 expended for stock imported as previously noted, which is not only an immediate help, but one whose cumulative benefits will extend through the coming years.

All of which is respectfully submitted.

MAXWELL SMITH,
Chairman.

FINANCIAL STATEMENT OF LAND SETTLEMENT BOARD FROM JANUARY 1ST TO DECEMBER 31ST, 1918.

AGRICULTURAL CREDIT COMMISSION ACCOUNTS.

AGRICULTURAL CREDIT COMMISSION.

Trial Balance as at December 31st, 1918.

	Dr.	Cr.
Debenture Account	.....	$1,000,000 00
Bank	$ 15,400 25	.....
Discount on debenture sales	142,613 34	.....
Interest on deposits	.....	2,077 44
Appraisal fees	.....	278 00
Equipment Account	616 22	.....
Interest, exchange, and discount	55 80	.....
Application fees, withdrawn	132 50	.....
Loans Account	741,429 95	12 50
Postage	5 00	.....
Legal fees	12 50	266 60
Interest on debentures	45,000 00	.....
Coupons Account	.....	3,780 00
Revenue and expenditure	41,216 24	.....
Interest accrued on loans	11,974 14	.....
Interest accrued on debentures	.....	7,500 00
Interest rebate	807 05	.....
Interest on loans	.....	48,746 62
U.S. premium on coupons	622 30	.....
Sinking Fund Account	1,044 49	.....
Interest on Sinking Funds	.....	3,087 95
Victory Loan bonds	71,000 00	.....
Bank of Commerce coupons	3,780 00	.....
Outstanding accounts owing	.....	10,104 45
Accrued Interest on Victory Loan bonds	379 72	.....
Discount on Victory Loan bonds	.....	231 94
Registry Office, Victoria	.....	2 50
Registry Office, Kamloops	.....	1 50
	$1,076,089 50	$1,076,089 50

LAND SETTLEMENT BOARD.

Revenue and Expenditure Accounts for Year ending December 31st, 1918.
A.C.C. Accounts.

Expenditure.		Revenue.	
Proportion expenses, L.S.B.	$ 7,510 30	Interest on deposits	$ 2,077 44
Printing, stationery, and postage	92 85	Interest on loans	48,746 62
Furniture and equipment, 10 per cent. written off	61 62	Interest on investment of Sinking Funds	3,087 95
Telephone Account	12 70	Discount on investment of Sinking Funds	231 94
Legal expenses, trustee fees	200 00	Appraisal fees	31 00
Interest on debentures	45,000 00	Legal fees	254 10
Interest rebates on loans	807 05	Balance: Deficit on year's operations to December 31st, 1918, carried to balance-sheet	6,045 57
Exchange, discount, and commission	55 80		
U.S. premium on coupons	622 30		
Discount on debentures, 1/25 written off	6,112 00		
	$60,474 62		$60,474 62

LAND SETTLEMENT BOARD.

Statement of Assets and Liabilities as at December 31st, 1918.

A.C.C. Accounts.

Assets.			Liabilities.	
Cash, Canadian Bank of Commerce, Current Account		$ 15,400 25	Debentures	$1,000,000 00
Canadian Bank of Commerce, Coupon Account		3,780 00	Appraisal fees	114 50
Discount on debenture sales		136,501 34	Coupons unpaid	3,780 00
Furniture and equipment		554 60	Accrued interest on debentures	7,500 00
Loans on security of first mortgage		735,708 93	Outstanding accounts payable	17,915 30
Interest outstanding on loans		5,708 52	Registry charges	4 00
Accrued interest on loans		11,974 14		
Sinking Funds		72,424 21		
Victory Loan bonds	$71,000 00			
Can. Bank of Commerce	1,044 49			
Accrued interest on Victory Loan bonds	379 72			
Province of British Columbia: Deficits, 1916 and 1917		41,216 24		
Balance: Deficit, 1918		6,045 57		
		$1,029,313 80		$1,029,313 80

Deficit, 1916	$19,015 32
Deficit, 1917	22,200 92
Deficit, 1918	6,041 57
Total deficit	$47,257 81

FINANCIAL STATEMENT OF LAND SETTLEMENT BOARD FROM JANUARY 1ST TO DECEMBER 31ST, 1918.

LAND SETTLEMENT BOARD ACCOUNTS.

LAND SETTLEMENT BOARD.

Trial Balance as at December 31st, 1918.

	Dr.	Cr.
Cash	$ 200 00	.....
Appraisal fees received	.....	$ 1,207 50
Exchange and discount	.....	10 97
Loans, controlling	468,850 00	.....
Treasury Account	71,302 70	.....
Directors' expenses	6,235 39	.....
Postage	350 00	.....
Members' impress	1,200 00	.....
Salaries, office staff	10,354 60	.....
Salaries, members	8,480 35	.....
Appraisal fees refunded	189 00	.....
Loans granted	.....	107,425 14
Legal fees, etc.	.....	174 83
Expenses	10 50	.....
Land purchase	3,215 35	.....
Interest on Treasury withdrawals	17,303 61	.....
Accrued interest on loans	4,258 80	.....
Interest on loans	.....	22,202 67
Stationery Account	518 25	.....
Office equipment	335 28	.....
Directors' equipment	89 25	.....
Outstanding accounts payable	.....	1,504 75
Outstanding accounts receivable	8,977 51	.....
Revenue and expenditure	1,534 53	.....
Appropriations	.....	522,780 00
Registrar, Prince Rupert	.....	69 05
Registrar, Nelson	.....	35 25
Registrar, New Westminster	.....	7 50
Registrar, Kamloops	.....	90 68
Registrar, Victoria	.....	3 50
Rebate of interest	2,194 86	.....
Telegrams and telephone	165 68	.....
Accrued interest on live-stock sales	174 92	.....
Interest on live-stock sales	.....	174 92
Directors' expenses outstanding	.....	334 85
Office salaries (bonus)	.....	177 00
Live-stock Purchase Account	727 19	.....
Fernie-Hosmer Area	845 16	.....
Cameron Drainage District	386 50	.....
Settlement Area No. 2	2,160 56	.....
Settlement Area No. 1	1,150 05	.....
West Nicomen Dyking District	3,012 68	.....
Sumas Dyke project	6,092 41	.....
Area No. 2, Land Purchase Account	13,096 93	.....
Cherry Creek project	1,404 38	.....
Area No. 1, Land Purchase Account	2,759 50	.....
Live-stock sales	17,739 02	.....
Palling Settlement Area	194 70	.....
Cranbrook drainage	534 40	.....
Comox Valley logged-off lands	154 55	.....
	$656,198 61	$656,198 61

LAND SETTLEMENT BOARD.

Revenue and Expenditure Accounts for Year ending December 31st, 1918.

L.S.B. Accounts.

Expenditure.			Revenue.	
Salaries—			Proportion expenses, A.C.C.	$ 7,510 30
Office staff	$10,354 60		Appraisal fees	889 50
Directors	8,480 35		Legal fees	174 83
		$18,834 95	Exchange and discount	10 97
Travelling expenses, Directors		6,235 89	Interest on loans	22,202 67
Office expenses—			Interest on live-stock sales	174 92
Postage	$ 315 00		Balance: Deficit on year's operations to December 31st, 1918, carried to balance-sheet	15,197 14
General	10 50			
Stationery written off	275 50			
Furniture written off	15 28			
Telephone and telegrams	152 98			
		769 26		
Directors' equipment		9 25		
Expenses, live-stock purchase		727 19		
Interest on Treasury advances		17,388 93		
Interest rebate on loans		2,194 86		
		$46,160 33		$46,160 33

LAND SETTLEMENT BOARD.

Statement of Assets and Liabilities as at December 31st, 1918.

L.S.B. Accounts.

Assets.		Liabilities.		
Cash on hand	$ 200 00	Appraisal fees unearned		$ 129 00
Loans granted	468,850 00	Province of British Columbia, appropriations		522,780 00
Treasury Account	71,217 38	Loans Account, due to borrowers		107,425 14
Members Impress Account	1,200 00	Accounts payable—		
Land Purchase Account	3,215 35	Sundry	$1,631 60	
Accrued interest on loans	4,258 80	Registry Offices	206 48	
Stationery	200 00	Directors' expenses	334 85	
Office furniture and fittings	320 00	Bonus to office staff	177 00	
Directors' equipment	80 00			2,349 93
Accounts receivable	16,588 36			
Accrued interest on live-stock sales	174 92			
Live-stock sales	17,739 02			
Settlement Area No. 1	1,208 45			
Settlement Area No. 2	2,218 91			
Area No. 1, purchase	2,759 50			
Area No. 2, purchase	13,096 93			
Fernie-Hosmer Area	845 16			
Palling Area	194 70			
Comox Valley logged-off lands	154 55			
West Nicomen Dyking District	3,012 68			
Sumas Dyke project	6,092 41			
Cameron Drainage District	386 50			
Cherry Creek project	1,404 38			
Cranbrook drainage	534 40			
Deficit for year ending Dec. 31st, 1917	1,534 53			
Deficit for year ending Dec. 31st, 1918	15,197 14			
	$632,684 07			$632,684 07

Deficit, 1917	$ 1,534 53
Deficit, 1918	15,197 14
Total deficit	$16,731 67

I hereby certify that the accompanying balance-sheets are in accordance with the books of the Land Settlement Board (including the separate books of the Agricultural Credit Commission), and exhibit a true and fair statement of the financial position of the Board as at December 31st, 1918, and the result of the operations for the year ended that date. The Board has not, however, statutory authority to make advances, amounting to $11,430.37, out of Land Settlement Board funds on behalf of the following dyking districts and dyking projects: West Nicomen, Sumas, Cameron Lake, Cherry Creek, and Cranbrook; and I have so reported to the Honourable the Minister of Agriculture.

A. N. MOUAT,
Comptroller-General.

Victoria, B.C., February 14th, 1919.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1919.

FIFTH ANNUAL REPORT

OF THE

PROVINCIAL INDUSTRIAL SCHOOL FOR GIRLS

FOR THE PROVINCE OF

BRITISH COLUMBIA

BY THE SUPERINTENDENT

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

To His Honour Sir Frank Stillman Barnard, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

May it please Your Honour:

The undersigned has the honour to submit herewith the Fifth Annual Report of the Superintendent of the Provincial Home for Girls.

All of which is respectfully submitted.

J. W. de B. FARRIS,
Attorney-General.

Attorney-General's Department,
Victoria, B.C., March, 1919.

PROVINCIAL INDUSTRIAL SCHOOL FOR GIRLS.

SUPERINTENDENT'S FIFTH ANNUAL REPORT.

VANCOUVER, B.C., November 30th, 1918.

Honourable J. W. de B. Farris,
Attorney-General, Victoria, B.C.

SIR,—I have the honour to submit to you and the Honourable Members of the Legislature the Fifth Annual Report of the Provincial Industrial School for Girls, from January 1st to November 30th, 1918.

The present incumbent assumed the duties of Superintendent on January 1st, 1918. Since no two persons work alike, it was deemed best to make a complete change of policy rather than attempt to revise the old system. This will explain the changes noted below.

The policy pursued is to have the girls realize that this is not so much a place of punishment, but rather that here they are given another chance to make good. Believing that girls would prefer to be good girls and to be held in esteem by good people, no effort has been spared to achieve this purpose. The prison style of wearing the hair was abolished the very first day. Bright ribbons and pretty modes of hairdressing are encouraged. The unbecoming uniform has been replaced by one more girlish and pleasing.

A system of honour stripes has been adopted. For being on the honour roll for three months a girl is entitled to one stripe. Four stripes may thus be earned. A further period of three honour months will earn a different style of dress known as the honour or trusty uniform. An additional period of three honour months gives the right to wear a white collar on the trusty uniform.

As far as possible the honour system has been introduced. The transition here to the honour system had the customary results experienced in other institutions making the change—namely, an increased number of runaways. The new liberty had much the same effect as that of emancipation upon the negroes of the South, whose first act of freedom was to run away.

Instead of meals being eaten in silence under rigid surveillance, conversation in moderate tones is permitted under staff supervision. After repeated changes in the personnel a staff has been engaged who are not only efficient, but whose manners, temperament, and high ideals make them examples worthy of emulation. A harmonious home atmosphere has been effected.

Sufficient time has not elapsed to test the results of the honour system upon the released inmates. So far as conduct in the school is concerned, the girls have a kindlier attitude towards the staff, whom they regard as friends rather than custodians. Their attitude towards each other is gentler, more refined, and more moral. They work more cheerfully and take pride in doing it well.

System of Marks.—In adopting a new system of marking, it was deemed best to emphasize desirable features in character-building, and the following plan has been adopted:—

	MARKS.
Honesty, including honesty of purpose	1
Punctuality	1
Orderliness	1
Courtesy	1
Spirit towards work and institution generally	1
Effort	1
Good influence	5
Efficiency	5

Four marks are allowed to the Superintendent to correct any overindulgence or severity on the part of the staff. For one week's good conduct one day of time is remitted. For one month's good conduct one day additional is remitted.

A group of Vancouver women interested in the welfare of the institution have presented a handsome Victrola. A number of friends have contributed records that are an endless source of enjoyment.

To the Vancouver Woman's Musical Club the school is indebted for the gift of a very fine piano. Individual members of the same club are giving lessons to the girls in both piano and voice.

Under the auspices of the University Woman's Club there was conducted a Little Mothers' League, at which were given a series of talks on "The Care of the Baby." These were illustrated by using a life-size baby doll, a complete layette, baby bed, and food equipment. The lectures were given by Miss Cole, of the Victorian Order of Nurses; Miss Breeze, Head Nurse for Vancouver City Schools; and Miss Waterman, Superintendent of Infants' Hospital.

Visitors.—During the year there were many visitors to learn of the working of the institution. Among these were the Honourable the Attorney-General, J. W. de B. Farris; the Honourable the Minister of Lands, T. D. Pattullo; Mrs. Ralph Smith, M.L.A.; Rev. F. A. Robinson, M.A., Toronto, Secretary of Evangelism for the Presbyterian Church of Canada; Rev. A. M. MacDonald, Edmonton, Superintendent of Neglected Children for Alberta; and the well-known author, Mrs. Nellie McClung, Edmonton. The latter gave a most inspiring talk to the girls, by whom it was very much enjoyed.

All the girls are given training in the countless details of housework, including cleaning, washing, ironing, cooking, bread-making, care of and waiting upon the table, and the mending and making of clothing. All this is on an institutional scale. When a course in Domestic Science is established it is hoped that the girls will be trained that they can assume full charge of the domestic work in the best houses.

In the school-room the half-day system is followed. The sessions have been lengthened to three hours instead of two hours and a half. Special training is given in drill and sight-singing in music. Excellent progress is being made under a painstaking teacher.

A Commercial Course has been established, covering instruction in stenography and typewriting. No one is permitted to take up the Commercial Course without having an academic standing equal to Entrance-work in the public school. By the end of the year five girls will be fitted to fill positions as stenographers, while one other has already gone out to complete her course in a city business college. Economic independence will do much towards sustaining a girl's moral reclamation.

During the early summer the men from Oakalla Prison Farm cleared an acre of ground. Part was completed in time to plant with potatoes that yielded at the rate of 7 tons to the acre. The remainder of the clearing was given over to our five "Victory" pigs, maintained at small outlay and valuable not only as food, but for rooting and fertilizing the raw land.

From the clearing there was salved some 65 cords of wood and about 1,000 lineal feet of cedar posts, ample compensation for the expenditure involved.

A number of minor improvements were made in the building, rendering it more secure and convenient. The former tile roof was used to pave the driveway. A dormitory that lacked dressing and lavatory facilities was converted into two staff bedrooms and staff sitting-room. Two other dormitories were provided with inspection windows between staff bedrooms and dormitory. Two rooms in the staff quarters were converted into secure and sanitary cell chambers by using cages from the Oakalla Prison Farm, thus replacing the unlighted, unventilated, and insanitary "black hole" formerly in use.

Commodious linen, medicine, and school-room cupboards were built on the dormitory floor. Electric bells now connect the dormitories with the staff rooms, enabling the girls to communicate with staff in case of illness or emergency instead of shaking the doors and waking the whole house.

The drying-room in the laundry has recently been made available for drying purposes for the first time in the history of the institution. Clothes-boilers have been built in that greatly facilitate the work on washing-days.

Instead of using the septic tank the sewer has been connected with the city sewage system.

All these changes kept a number of workmen busy on the premises for many weeks. This very much restricted the outdoor occupations of the girls, and the unusual noises and activities are largely responsible for the difficulties in discipline in the early summer.

Early in the year Dr. Mary Campbell made a careful examination of each girl. As a result about 50 per cent. of them were given specific treatment for venereal infection. The number is now greatly reduced. Each new arrival is segregated in the hospital until the doctor has pronounced her free from contagion. She is then given sleeping-quarters in the dormitory.

The general health of the girls has been carefully looked after by the matron, who is a trained nurse. One inmate, a chronic invalid, required constant care for six months. Ever since her discharge from here she has been a patient at the Vancouver General Hospital. During the recent epidemic there were but two mild cases of influenza. Our immunity is due to scrupulous cleanliness, plain, wholesome diet, regular hours, daily fumigation, and unceasing vigilance.

The reports of the schools most successful with delinquents show that the psychological tests are used as a scientific basis for reform-work. The inability to resist temptation owing to subnormal mentality is the cause of most failures in the work of moral reclamation.

This institution was fortunate to secure the services of the psychological clinician on the staff of the Vancouver public schools. The psychological report of Miss Martha Lindley shows a large percentage of subnormals in this school. It is worthy of serious thought and points to the very urgent need of providing constant custodial care for many of the inmates, so that society may be relieved of a serious menace and a perpetuation of feeble-mindedness.

The year's experience has shown that provision ought to be made for the separate accommodation of the persistently incorrigible and vicious, who are a constant disturbance to the well-being of the institution, and who very much lessen the chance of reform among the more promising ones. This will obviate the necessity of using a wing in the Oakalla Prison Farm for the older and more vicious girls who are committed here from the Police Court.

Number of Inmates received.—The roll of the institution on January 1st showed thirty-nine inmates. During the year twenty new girls were received, making a total of ninety admitted since the opening of the building on April 3rd, 1914. Of these, thirty-six are still inmates of the institution.

Released on Probation or discharged.—During the year we have released on probation or discharged twenty-three girls. Of these, eight were returned to the custody of the parents; seven who had not suitable homes with relatives were placed in good positions at a proper rate of wages; two were placed on probation to the Vancouver City Mission; two were given into the custody of the Indian Department; one was made a ward of the Catholic Children's Aid; one was apprenticed to the monastery; one was transferred to the Salvation Army Maternity Home; one was released by an order from the County Court.

Countries where born.—Of the thirty-six girls now in the school, twenty-five were born in Canada, four in the United States, four in England, and three is Scotland.

Nationality.—Thirteen are of Canadian descent, ten of English, five of Scotch, three of half-caste Indian, two of Indian, two of American, and one of Irish.

Length of Sentence.—Five are given two years; thirty-one have been given indefinite sentences of not less than two years.

Age at Commitment.—At eleven years, 1; twelve years, 1; thirteen years, 2; fourteen years, 6; fifteen years, 8; sixteen years, 11; seventeen years, 7.

Offences committed.—Incorrigibility, 26; theft, 5; keeping house of ill-fame, 2; vagrancy, 1; arson, 1; forgery, 1.

Escapes.—During the year there have been twenty-two escapes. All were soon recaptured, some within half an hour after their exit. There are many causes for these runaways; chief among them are lack of active employment, lack of physical exercise, the exposed and public situation of the institution, and the subnormal mentality of over 50 per cent. of the girls that makes them the victims of unwise leadership.

The insecurity of the building has been largely corrected, making a contemplated exit somewhat more difficult and discipline by segregation a possibility.

More outdoor work is a paramount necessity. It provides wholesome exercise, can be made instructive in the knowledge of growing things, turns into useful channels all surplus energy, and is conducive to moral conduct. Hence the urgent desire that the area of tillable land be extended by clearing the entire acreage around the building.

A substantial fence should enclose the cleared portion of land. This will also obstruct the view of ill-disposed passers-by and prevent the present almost nightly visits from prowlers around the building. Some sort of covered structure should be provided for exercise in rainy weather.

The ideal aimed at is to give the girls as great a share in outdoor work and games as in housework. To inculcate a love for animal pets and for all growing things, to create a love for

a wholesome outdoor life and simple pleasures, will go far to effect a girl's moral reclamation. Besides this, the labour of the girls will greatly assist in making the place self-supporting.

In conclusion, I would respectfully suggest that a copy of the evidence or a history of the facts of the case be furnished with a girl's commitment papers. The officers accompanying the girls very often do not know their charge's history. The girl herself seldom reports it correctly, so that the Superintendent is at a disadvantage in not knowing the girl's true story, and the work of reformation is hampered.

The following is the present staff of officials:—

Superintendent—Margaret W. Bayne.
Matron—Mary B. Menzies.
First Assistant—Laura Jewell.
Second Assistant—May Mitchell.
Laundrywoman—Jennie F. Ham.
Needlewoman—Barbara Sample.
Cook—Grace Grant.
Teacher—Janet A. G. Mill.
Commercial Teacher—Annie Edgell Sprott.
Gardener—F. W. Cameron.
Engineer—J. R. Clark.

All of which is respectfully submitted.

MARGARET W. BAYNE,
Superintendent.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

PRINTING OFFICE REPORT.

To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

In accordance with section 14 of the "Statutes and Journals Act," I have the honour to present the following Report.

I have the honour to be,
Sir,
Your obedient servant,
J. D. MACLEAN,
Provincial Secretary.

PRINTING OFFICE REPORT.

RETURN showing the number of copies of the Statutes, Journals, and Sessional Papers which have been bound, distributed, and disposed of during the twelve months ending 31st March, 1918, and the number remaining on hand on the 31st March, 1918, together with a statement of the work performed in the Printing Office, and the expenses incurred by the Department during that period, in accordance with the "Statutes and Journals Act."

Year.	Statutes.					Journals.					Sessional Papers.					Work Performed.				No. of Impressions Printed.	Expenses of Department.			Revenue Received.
	On hand 1st April, 1917.	Bound.	Distributed.	Sold.	Remaining on hand 31st March, 1918.	On hand 1st April, 1917.	Bound.	Distributed.	Sold.	Remaining on hand 31st March, 1918.	On hand 1st April, 1917.	Bound.	Distributed.	Sold.	Remaining on hand 31st March, 1918.	No. of Jobs.	No. of Pages. Plain.	No. of Pages. Tabular.	Total No. of Pages		Salaries.	Printing Material, Paper, etc.	Total.	
1872	.....	.....	.....	.....	.....	13	.....	.....	.....	13	.....	.....	.....	.....	.....									
1875	3	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....									
1876	13	.....	.....	.....	13	19	.....	.....	.....	19	.....	.....	.....	.....	.....									
1878	.....	.....	.....	.....	.....	9	.....	.....	.....	9	.....	.....	.....	.....	.....									
1880	.....	.....	.....	.....	.....	8	.....	.....	.....	8	.....	.....	.....	.....	.....									
1886	15	.....	.....	.....	15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....									
1887	35	.....	.....	.....	35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....									
1888	25	.....	.....	.....	25	6	.....	.....	.....	6	.....	.....	.....	.....	.....									
C.A. 1888	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....									
1889	1	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....									
1890	1	.....	.....	.....	1	13	.....	.....	.....	13	.....	.....	.....	.....	.....									
1891	1	.....	.....	.....	1	10	.....	.....	.....	10	.....	.....	.....	.....	.....									
1892	.....	.....	.....	.....	.....	10	.....	.....	.....	10	.....	.....	.....	.....	.....									
1893	1	.....	.....	.....	1	17	.....	.....	.....	17	.....	.....	.....	.....	.....									
1894	.....	.....	.....	.....	.....	8	.....	.....	.....	8	.....	.....	.....	.....	.....									
1895	1	.....	.....	.....	1	23	.....	.....	.....	23	.....	.....	.....	.....	.....									
1896	1	.....	.....	.....	.....	32	.....	.....	.....	32	.....	.....	.....	.....	.....									
1897	1	.....	.....	.....	.....	32	.....	.....	.....	32	.....	.....	.....	.....	.....									
R.S. 1897	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....									
1898	.....	.....	.....	.....	.....	11	.....	.....	.....	11	.....	.....	.....	.....	.....									
1899	.....	.....	.....	.....	.....	12	.....	.....	.....	12	.....	.....	.....	.....	.....									
1901	1	.....	.....	.....	1	.....	.....	.....	.....	.....	36	.....	.....	.....	36									
1902	.....	.....	.....	.....	.....	36	.....	.....	.....	36	.....	.....	.....	.....	.....									
1903	.....	.....	.....	.....	.....	45	.....	.....	.....	45	36	.....	.....	.....	36									
1903-4	.....	.....	.....	.....	.....	12	.....	.....	.....	12	1	.....	.....	.....	1									
1905	.....	.....	.....	.....	.....	13	.....	.....	.....	13	25	.....	.....	.....	25									
1906	.....	.....	.....	.....	.....	41	.....	.....	.....	41	34	.....	.....	.....	34									
1907	132	.....	.....	1	131	20	.....	.....	.....	20	.....	.....	.....	.....	.....									
1908	90	.....	27	.....	63	58	.....	.....	.....	58	23	.....	.....	.....	23									
1909	53	22	.....	.....	75	42	.....	.....	.....	42	33	.....	.....	.....	33									
1910	138	.....	6	.....	132	155	.....	.....	.....	155	.....	.....	.....	.....	.....									
1911	58	.....	5	53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....									
R.S. 1911	4	43	32	11	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....									
1912	361	.....	68	13	280	240	.....	.....	.....	240	82	.....	.....	.....	82									
1913	418	.....	85	15	318	180	.....	.....	.....	180	26	.....	.....	.....	26									
1914	119	45	36	18	110	207	.....	.....	.....	207	9	.....	.....	.....	9									
1915	141	38	33	25	121	63	.....	.....	.....	63	16	.....	.....	.....	16									
1916	28	57	32	25	28	162	.....	.....	.....	162	6	.....	.....	.....	6									
1917	.....	801	488	233	80	.....	254	192	.....	62	.....	241	226	.....	15									
Vol. 4, R.S. 1911.	14	.....	.....	1	13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,308	12,460	1,238	13,698	6,771,478	$80,469 71	$52,056 44	$132,526 15	$37,587 42

Memo.—In noting the quantity of work performed for the period, it should be borne in mind that the majority of the tabular work was printed in very small type (Nonpareil), nearly all of the pages containing not less than 6,600 ems, and that, according to established rules, double composition should be allowed for this description of work. Although the above return shows the net results for the period, yet a large amount of unavoidable additional work was necessitated by making alterations from the original drafts in Bills submitted to the Legislature, and in reports and other documents, which it is impossible to include in this return.

Persons and Departments to whom Statutes, Journals, and Sessional Papers have been distributed during twelve months ending March 31st, 1918.

To Whom Distributed.	Statutes, 1917.	Journals, 1917.	Sessional Papers, 1917, 2 Vols.
Members of the Legislative Assembly	94	94	94
Senators	5	5	5
Members of the House of Commons	7	6	6
Provincial Departments—			
His Honour the Lieut.-Governor, Victoria	1	1	1
Lieut.-Governor's Office, "	.....	.....	1
Premier's Office, "	.....	.....	1
President, Executive Council, "	.....	1	1
Provincial Secretary, "	1	1	1
Deputy Provincial Secretary, "	1	1	1
Provincial Secretary's Department, "	1	1	1
Attorney-General, "	1	1	1
Deputy Attorney-General, "	1	1	1
Attorney-General's Department, "	2	1	1
Departmental Solicitor, "	1	.....	.....
Minister of Finance, "	1	1	1
Deputy Minister of Finance, "	1	1	1
Comptroller-General, "	1	1	1
Minister of Lands, "	1	1	1
Deputy Minister of Lands, "	1	1	.....
Lands Department, "	1	.....	1
Public Works Engineer, "	1	1	1
Minister of Works, "	1	1	1
Deputy Minister of Works, "	1	1	.....
Works Department, "	.....	.....	1
Minister of Mines, "	1	1	1
Deputy Minister of Mines, "	1	1	.....
Mines Department, "	.....	1	1
Printing Office, "	3	3	3
Executive Council, "	1	1	1
Superintendent of Education, "	1	1	1
Registrar-General of Titles, "	1	.....	.....
Superintendent of Police, "	1	.....	.....
Water Commissioner, "	1	.....	.....
Railways Department, "	1	.....	.....
Legislative Library, "	18	18	18
Surveyor-General, "	1	.....	.....
Minister of Agriculture, "	1	.....	1
Deputy Minister of Agriculture, "	1	.....	.....
Library, Department of Agriculture, "	1	.....	1
Live Stock Commissioner, "	1	.....	.....
Provincial Assayer, "	1	.....	.....
Inspector of Legal Offices, "	1	.....	.....
Registrar of Joint-stock Companies, "	1	.....	.....
Surveyor of Taxes, "	1	.....	.....
Inspector of Trust Companies, "	1	.....	.....
Inspector of Municipalities, "	1	.....	.....
Clerk, Legislative Assembly, "	1	1	.....
Law Clerk, Legislative Assembly, "	1	1	.....
Provincial Board of Health, "	1	.....	1
Judges of Appeal Court, "	5	.....	.....
" " Vancouver	5	.....	.....
Chief Justice	1	.....	.....
Judges of Supreme Court	6	.....	.....
District Registrar of Titles, Vancouver	1	.....	.....
" " New Westminster	1	.....	.....
" " Kamloops	1	.....	.....
" " Nelson	1	.....	.....
" " Prince Rupert	1	.....	.....
Registrar, Supreme Court, Vancouver	1	.....	.....
" " Cranbrook	1	.....	.....
" " Prince Rupert	1	.....	.....
" " New Westminster	1	.....	.....
" " Revelstoke	1	.....	.....
" " Nelson	1	.....	.....
" " Victoria	1	.....	.....
" County Court, Nanaimo	1	.....	.....
" " Chilliwack	1	.....	.....
" " Vancouver	1	.....	.....
" " Victoria	1	.....	.....
" " Trout Lake	1	.....	.....
" " Atlin	1	.....	.....
" " Merritt	1	.....	.....
" " Ladysmith	1	.....	.....
County Court Judge, Nanaimo	1	.....	.....
" " Prince Rupert	1	.....	.....
" " Grand Forks	1	.....	.....
" " New Westminster	1	.....	.....
" " Kamloops	1	.....	.....
" " Ashcroft	1	.....	.....
" " Nelson	1	.....	.....
Carried forward	211	149	151

To Whom Distributed.	Statutes, 1917.	Journals, 1917.	Sessional Papers, 1917.
Brought forward	211	149	151
Provincial Departments—*Concluded.*			
County Court Judge, Vancouver	3		
" " Victoria	1		
" " Cranbrook	1		
" " Prince George	1		
Sheriffs—			
Victoria	1		
Vancouver	1		
Nelson	1		
New Westminster	1		
Kamloops	1		
Grand Forks	1		
Nanaimo	1		
Quesnel	1		
Golden	1		
Prince Rupert	1		
Revelstoke	1		
Prince George	1		
Law Library, Victoria	3		
" Vancouver	3		
" New Westminster	2		
" Kamloops	1		
" Nelson	1		
" Fernie	1		
" Greenwood	1		
" Vernon	1		
" Cranbrook	1		
" Grand Forks	1		
" Prince George	1		
Fruit Inspector, Vancouver	1		
Assessor and Collector, Vancouver	1		
" Victoria	1		
Inspector of Mines, Fernie	1		
Provincial Timber Inspector, Vancouver	1		
Superintendent of Prison Farm, Oakalla	1		
L. S. Klinck, President, University of British Columbia, Vancouver	1		
John Conway, Mining Recorder, Stewart, B.C.	1		
J. P. Dean, Murrayville, B.C	1		
Government Agents—			
Duncan	1		
Nanaimo	1		
Cumberland	1		
Barkerville	1		
New Westminster	1		
Ashcroft	1		1
Clinton	1		1
Kamloops	1		
Golden	1		1
Revelstoke	2		
Vernon	1		1
Alberni	1		
Nelson	1		
Cranbrook	1		
Atlin	2		
Telegraph Creek	1		
Rossland	1		
Prince Rupert	1		
Kaslo	1		1
Vancouver	1		1
Nicola	1		
Fairview	1		
Grand Forks	1		
Hazelton	1		
Greenwood	1		
Fernie	1		
150-Mile House	1		
Wilmer	1		
Princeton	1		
Queen Charlotte City	1		
Fort Fraser	1		
South Fort George	1		
Quesnel	1		
Anyox	1		
Stipendiary Magistrates—			
New Denver	2		
Rossland	1		
Penticton	1		
Cumberland	1		
Trail	1		
Grand Forks	1		
Fernie	1		
Victoria	1		
Ashcroft	1		
Enderby	1		
Cranbrook	1		
Merritt	1		
New Westminster	1		
Carried forward	304	149	157

To Whom Distributed.	Statutes, 1917.	Journals, 1917.	Sessional Papers, 1917.
Brought forward	304	149	157
Stipendiary Magistrates—*Concluded.*			
Masset	1		
Summerland	1		
Kerrisdale	1		
Courtenay	1		
Silverton	2		
Prince George	1		
South Vancouver	1		
Edmonds	1		
Kamloops	1		
Vancouver	1		
Ocean Falls	1		
Agassiz	1		
Chase	1		
Bella Coola	1		
Nelson	1		
Justices of the Peace—			
W. R. Hillyer, Solsqua	1		
Malcolm B. J. Reid, Immigration Branch, Vancouver	1		
Thos. Wilson, Brackenbrae Farm, Stave Falls	1		
Maurice A. Porter, Royal Bay, R.R. Route No. 1, Victoria	1		
Fred'k F. Higgs, Albert Head	1		
Jas. F. Summerfield, care W. C. Brown, 403-407 Rogers Building, Vancouver	1		
Percy T. R. Carnac, Box 116, Chemainus	1		
Aaron B. Ball, Comox	1		
Chas. King, Greenwood	1		
Leonard E. Farr, Armstong	1		
Wm. H. Jones, 912 Edgewood Avenue, Nelson	1		
Alfred Adams, "The Glen," R.R. No. 1, Vernon	1		
M. A. Wylde, Shawnigan	1		
J. W. Ambery, 518 Fort Street, Victoria	1		
R. E. Walker, "Ragley," East Sooke	1		
J. Dixon, Natal	1		
Edward Graham, Denman Island	1		
Geo. H. Outram, Vanderhoof	1		
Samuel J. Emanuels, 419 Pender Street W., Vancouver	1		
John Roberts, Box 223, Field	1		
O. J. Reid, Chilco	1		
Edwin W. Widdowson, Nelson	1		
N. W. Burdeth, Kimberley	1		
Geo. Leece, Drawer 509, Ymir	1		
John H. Hayes, Fort Steele	1		
E. H. Robinson, Alert Bay	1		
Provincial Constables—			
Greenwood	1		
Hazelton	1		
Kamloops	1		
Golden	1		
Fernie	1		
Nelson	1		
Nanaimo	1		
Prince Rupert	1		
Vancouver	2		
Vernon	1		
Ashcroft	1		
South Fort George	1		
Telkwa	1		
Clinton	1		
Dominion Departments—			
Library of Parliament, Ottawa	3	1	4
Law Clerk, House of Commons	1	1	
Commissioner of the Yukon Territory, Dawson, Y.T.	1		
Deputy Minister of Justice, Ottawa	2		
Supreme Court Library, Ottawa	2		
Judges' Library, Ottawa	2	1	
Librarian, House of Parliament, Ottawa	1	1	
Jas. White, Secretary, Committee of Conservation, Ottawa	1		
Secretary of State, Ottawa			1
Under Secretary of State, Ottawa	1	1	
Minister of Labour, Ottawa	1		
Law Clerk, Senate, Ottawa	1		
Secretary of State, Ottawa (for Colonial Office, London)	6		
Sir E. P. Morris, Premier, St. Johns, Newfoundland			1
Board of Trade, Victoria, B.C.			1
T. K. Doherty, Institute Commissioner, Agricultural Department, Ottawa	1		1
Superintendent of Immigration, Ottawa	1		
Deputy Postmaster, Ottawa	1		
Bureau of Statistics, Department of Trade and Commerce, Ottawa	1		
Registrar of Supreme Court of Canada, Ottawa	2		
Public Archives of Canada, Ottawa	1		
Great Britain—			
House of Lords (Library)	1		
House of Commons	1	1	1
British Museum, Great Russel Street, Bloomsbury, W.C.	1	1	1
Imperial Institute, South Kensington, S.W.	1	1	1
Royal Colonial Institute, 18 Northumberland Avenue, Charing Cross, W.C.	1	1	1
British Library of Political Science, Clare Market, W.C.	1		
Carried forward	396	158	169

To Whom Distributed.	Statutes, 1917.	Journals, 1917.	Sessional Papers, 1917.
Brought forward	396	158	169
Great Britain—*Concluded.*			
Society of Comparative Legislation, 5 New Square, Lincoln's Inn, London, W.C.	1		
Secretary of State for the Colonies, Downing Street	1	1	1
High Commissioner for Canada	1	1	1
Blake & Redden (Privy Council Library), 17 Victoria Street, London	1	1	
Gard, Lyell & Co., 2 Gresham Buildings, London, E.C.	1		
F. C. Wade, Agent-General for British Columbia	1	1	1
Hamer Greenwood, M.P., 4 Crown Office Road, Temple	1		
Law Library, Colonial Office, London	1		
Middle Temple Library, London, E.C.	1		
The Registrar, Privy Council Office, Downing Street, London	1		
Library of Inner Temple, London	1		
Library of Lincoln's Inn, London	1		
Board of Trade, London	1		
Incorporated Law Society, London	1		
Faculty of Gray's Inn, London	1		
Faculty of King's Inn, Dublin	1		
Library of the Faculty of Advocates, Edinburgh	1		
Solicitor's Hall, Edinburgh	1		
Bar Library, Royal Courts of Justice, London	1		
Estates Branch, Canadian Contingents, Westminster House, 7 Millbank, London, S.W.	1		
Provinces—			
Osgoode Hall, Toronto	1	1	1
Legislative Library, Toronto	1	1	1
" Quebec	1	1	1
" Winnipeg	1	1	1
" Halifax	1	1	1
" Fredericton	1	1	1
" St. John's, Newfoundland	1	1	1
" Charlottetown	1	1	1
" Edmonton, Alta.	1	1	1
" Regina, Sask.	1	1	1
Deputy Attorney-General, Winnipeg	1		
King's Printer, Halifax	1	1	1
Attorney-General, Halifax	1		
Attorney-General's Department, Edmonton, Alta.	1		
Attorney-General's Department, Regina, Sask.	1		
King's Printer, Quebec	1		
King's Printer, Winnipeg	1		1
Miscellaneous—			
Canadian Offices, 17 Boulevard des Capucines, Paris	1	1	1
McGill University, Montreal	1	1	1
Laval University, Montreal	1	1	1
Queen's University, Kingston	1	1	1
Dalhousie University, Halifax	1		1
University of Alberta, Strathcona	1	1	1
University of Saskatchewan, Saskatoon	1		1
W. R. Foster, Secretary, Barristers' Society, Halifax	1		
Calgary Public Library, Calgary, Alta.	1		1
Chas. H. Hutchings, Deputy Minister of Justice, St. John's, Newfoundland	1		
American Consul, Vancouver, B.C.	1		
Montreal Bar Library, Montreal	1	1	5
International Labour Office, Basle, Switzerland	1		
Office du Travail, Brussels	1		
Acting Consul-General, Belgian Consulate, Ottawa	1		
University Women's Club, Vancouver	1		
A. B. Buckworth, J.P., Winch Building, Vancouver	1		
B.C. University Library, Vancouver, B.C.			1
Public Library, Vancouver, B.C.			1
D. A. MacRae, Dean, Dalhousie University, Halifax, N.S.	1		
Hon. Mr. Justice Riddell, Osgoode Hall, Toronto	1		
Miscellaneous (United States)—			
Public Document Department, Public Library, New York (476 Fifth Avenue)	1	1	1
Sociology Library, Law Section, Albany, N.Y.	1		1
State Library, Boston	1		
" St. Paul, Minn.	1		1
" Concord, N.H.	1		
" Boise, Idaho	1		1
" Lincoln, Neb.	1		1
" Helena, Montana	1		1
" Denver, Colorado	1		1
" Madison, Wis.	1		1
" Cheyenne, Wyo.	1		1
" Hartford, Conn.	1	1	1
" Olympia, Wash.	1		1
" Atlanta, Georgia	1		
Supreme Court Library, Salem, Oregon	1	1	1
Library of Congress, Washington, D.C.	1	1	1
Library, Department of Attorney-General, Washington, D.C.	1		
Newberry Library, Chicago, Ill	1		
State Law Library, Augusta, Maine	1		
Public Library, Seattle, Washington	1		1
Law Library, Dayton, Ohio	1		
State Library, Des Moines, Iowa	1		1
Library, University of Washington, Seattle	1		1
University of Illinois, Urbana, Ill.	1		
Law Library, Cornell University, Ithaca, N.Y.	1		
Carried forward	477	183	215

To Whom Distributed.	Statutes, 1917.	Journals, 1917.	Sessional Papers, 1917.
Brought forward	477	183	215
Miscellaneous (United States)—*Concluded.*			
Secretary, Department of Agriculture, Washington, D.C.	1	.....	.....
Library, Columbia University, New York	1	.....	.....
State Historical Society of Wisconsin, Madison, Wisconsin	1	.....	1
Miscellaneous (Australasia)—			
State Parliamentary Library, Brisbane, Queensland	1	1	1
" " Melbourne, Victoria	1	1	1
" " Adelaide, South Australia	1	1	1
" " Perth, West Australia	1	1	1
" " Hobart, Tasmania	1	1	1
" " Wellington, N.Z.	1	1	1
Library of Parliament, Commonwealth of Australia, Melbourne, Victoria	1	1	1
Public Library of New South Wales, Sydney	1	.....	1
Colonial Secretary, Singapore, S.S.	1	1	1
Library of Parliament, Cape Town, S.A.	1	1	1
Total number	490	192	226

DISTRIBUTION OF DOCUMENTS OF PREVIOUS YEARS.

To Whom Distributed.	1902.	1903-4.	1905.	1907.	1909.	1910.	R.S. 1911.	1911. Vol. IV.	1912.	1913.	1914.	1915.	1916.	1917.	Totals.
Statutes.															
Library of Parliament, Ottawa	....	....	....	....	....	....	....	...	....	....	3	....	...	....	3
John Keen, J.P., Kaslo	....	....	....	....	....	....	....	....	....	....	1	1	...	....	2
M. B. J. Reid, J.P., Immigration Branch, Vancouver	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
A. F. Priestley, J.P., Ayansh	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Thos. Wilson, J.P., Brackenbrae Farm, Stave Falls	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
M. A. Porter, J.P., Royal Bay, R.D. No. 1, Victoria	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Fred'k F. Higgs, J.P., Albert Head, B.C.	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Jas. T. Summerfield, J.P., Vancouver, B.C.	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
P. T. R. Carnac, J.P., Chemainus	....	....	....	....	....	....	1	....	1	1	1	1	1	..	6
Aaron B. Ball, J.P., Comox	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Leonard E. Farr, J.P., Armstrong	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
W. H. Jones, J.P., Nelson	....	....	....	....	....	....	1	....	1	1	1	1	1	...	6
Alfred Adams, J.P., R.R. No. 1, Vernon	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
M. A. Wylde, J.P., Shawnigan	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
W. C. Findlay, J.P., Victoria	....	..	....	....	....	....	1	....	1	1	1	1	1	....	6
J. W. Ambery, J.P., Victoria	...	....	....	....	....	....	1	....	1	1	1	1	1	....	6
R. E. Walker, J.P., Sooke, B.C.	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
W. R. Hillyer, J.P., Solsqua	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Chas. King, J.P., Greenwood	...	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Hon. Mr. Justice Eberts	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
M. A. Macdonald, M.P.P., Vancouver	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
J. Dixon, J.P., Natal, B.C.	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
R. E. W. Biddell, Agassiz, B.C.	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Edward Graham, J.P., Denman Island, B.C.	....	...	....	....	....	....	1	....	1	1	1	1	1	....	6
Geo. H. Outram, J.P., Vanderhoof, B.C.	...	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Samuel J. Emanuels, J.P., Vancouver	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
E. A. Crease, S.M., Nelson	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
John Roberts, J.P., Field, B.C.	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Olney J. Reid, J.P., Chilco, B.C.	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Hugh H. McAlpine, S.M., Chase	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Wm. H. Gibson, S.M., Bella Coola	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
E. W. Widdowson, J.P., Nelson	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Robert J. Flowers, J.P., New Westminster	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Hon. G. H. Barnard	....	....	....	....	....	....	1	....	1	1	1	1	1	....	6
Registrar, County Court, Ladysmith	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Totals	....	....	....	....	....	....	32	....	32	32	36	33	32	1	198
Journals.															
Library of McGill University, Montreal	1	....	1	1	1	1	....	1	1	....	....	....	....	....	7
Victoria Library	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Totals	1	....	1	1	1	1	....	1	1	....	....	....	....	1	8
Sessional Papers.															
Library of McGill University, Montreal	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1
Totals	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1

STATEMENT of the number of the Statutes, Journals, and Sessional Papers sold during the twelve months ending March 31st, 1918; showing also the amount of revenue received and paid into the Treasury for the same period.

Particulars.	No of Copies Sold.	Amount Received.
Statutes, 1911	5	$ 12 00
" 1912	13	30 50
" 1913	15	35 50
" 1914	14	42 50
" 1915	25	60 00
" 1916	25	60 50
" 1917	233	807 50
Revised Statutes, 1911	11	208 00
" Vol. IV., 1911	1	5 00
Sale of other documents and advertising in B.C. Gazette	....	36,325 92
Total revenue received	....	$37,587 42

STATEMENT of number of bound British Columbia Gazettes distributed during year ended March 31st, 1918.

To Whom Distributed.	Year 1918.
Provincial Secretary	1
Executive Council	1
Speaker's Room	1
Legislative Library	1
Attorney-General's Office	1
Deputy Attorney-General	1
Minister of Lands	1
Deputy Minister of Lands	1
Lands Department (Front Office)	1
Lands Department (Mr. Cathcart)	1
Public Works Engineer	1
Assistant Public Works Engineer	1
Superintendent of Education	1
Water Rights Branch	1
Mines Department	1
Government Printing Office	1
Surveyor of Taxes	2
Surveyor-General	1
Department of Railways	1
Forest Branch	1
Inspector of Trust Companies	1
Agricultural Credit Commission	1
Registrar-General of Titles	1
Registrar of Titles, New Westminster	1
" Prince Rupert	1
" Vancouver	1
" Kamloops	1
" Nelson	1
Registrar, Supreme Court, Victoria	1
" " Vancouver	1
" County Court, "	1
" " New Westminster	1
" " Wilmer	1
Sheriff, New Westminster	1
District Forester, Vancouver	1
Government Agents—	
Nanaimo	1
Vernon	1
Nelson	1
Duncan	1
Rossland	1
Clinton	1
Grand Forks	1
Golden	1
Cranbrook	1
New Westminster	1
Revelstoke	1
Kamloops	1
Atlin	1
Cumberland	1
Barkerville	1
Alberni	1
Nicola	1
Hazelton	1
Fairview	1
Ashcroft	1
Prince Rupert	1
Princeton	1
Quesnel	1
Kaslo	1
Greenwood	1
150-Mile House	1
South Fort George	1
Fernie	1
Fort Fraser	1
Vancouver	1
Assessor and Collector, Victoria	1
Mining Recorder, Slocan	1
" Trout Lake	1
" New Denver	1
Total	70

FINANCIAL STATEMENT, 1917-18.

(1st April, 1917, to 31st March, 1918.)

EXPENDITURES.

Salaries	$ 70,514 81	
Extra Assistance and Overtime	9,954 90	
Printing Material, etc.	39,927 40	
Stationery Supplies	21,129 04	
		$132,526 15

PRINTING AND STATIONERY SUPPLIED VARIOUS DEPARTMENTS FOR 12 MONTHS ENDING MARCH 31ST, 1918.

Agricultural Department	$ 11,517 87	
Assessor and Collector	1,428 23	
Attorney-General's Department	1,499 93	
" " Industrial School, Boys	96 65	
" " " Girls	91 99	
Audit	815 03	
B.C. Gazette	15,699 65	
Births, Deaths, and Marriages	1,053 03	
County Court	549 25	
Dykes Department	84 75	
Education Department	10,750 24	
B.C. University	1,202 95	
Fisheries Department	928 80	
Forest Branch	3,681 64	
Government Agents	4,701 65	
Game Wardens	693 10	
Health Department	481 90	
Inspector of Legal Offices	116 82	
Inspector of Trust Companies	409 30	
Inspector of Factories	136 10	
Inspector of Machinery and Boilers	1,115 55	
Information Bureau	639 04	
Insurance Department	1,034 60	
Lands Department	7,285 19	
Land Registry Offices	3,095 09	
Legislation	14,562 27	
Library	2,257 25	
Lieutenant-Governor	105 95	
Mental Hospital	1,010 87	
Mines Department	5,096 51	
Museum	449 30	
Provincial Police	1,892 76	
Provincial Secretary's Department	2,078 48	
Provincial Gaols	93 63	
Premier's Office	189 20	
Printing Department	617 04	
Railway Department	355 75	
Registrar of Joint-stock Companies	713 70	
Surveyor of Taxes	5,010 05	
Sheriff	203 95	
Supreme Court	1,647 81	
Survey Branch	2,057 72	
Treasury Department	5,582 50	
Water Rights Branch	608 00	
Public Works Department	4,741 73	
Miscellaneous Stock	1,272 86	
Agricultural Credit Commission	25 55	
Canadian Patriotic Fund	442 80	
Returned Soldiers Commission	736 05	
Workmen's Compensation Act	1,120 35	
Land Settlement Board	810 50	
Stipendiary Magistrates	19 05	
Inspector of Electrical Energy	24 25	
Labour Department	163 90	
Prohibition Commission	929 62	
Comptroller-General	2,912 10	
Censor, Moving Pictures	227 31	
Inspector of Municipalities	184 55	
Taxation Board	45 85	
Telegraph Office	14 60	
	$ 127,312 16	
Total revenue received	37,587 42	
		164,899 58
		$ 32,373 43

VICTORIA, B.C.:

Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,

1919.

UNIVERSITY OF ILLINOIS LIBRARY

NOV 22 1920

REPORT

Of the Acting Minister of Justice upon the Statutes of the Legislative Assembly of the Province of British Columbia passed during the Session of 1918.

By Command.

J. D. MacLEAN,
Provincial Secretary.

Provincial Secretary's Office,
May 16th, 1919.

P.C. 949.

Certified Copy of a Report of the Committee of the Privy Council, approved by His Excellency the Governor-General on the 6th May, 1919.

The Committee of the Privy Council have had before them a report, dated 3rd May, 1919, from the Acting Minister of Justice, submitting that he has had under consideration the Statutes of the Legislature of the Province of British Columbia, passed in the eighth year of His Majesty's reign (1918), and received by the Secretary of State of Canada on the 14th day of May last, and that he is of the opinion that these Statutes may be left to such operation as they may have.

The Committee, on the recommendation of the Acting Minister of Justice, advise that a copy hereof, together with the accompanying report, be transmitted to the Lieutenant-Governor of British Columbia for the information of his Government.

All which is respectfully submitted for approval.

RODOLPHE BOUDREAU,
Clerk of the Privy Council.

His Honour the Lieutenant-Governor of British Columbia.

Department of Justice, Canada.

Ottawa, 3rd May, 1919.

To His Excellency the Governor-General in Council:

The undersigned has the honour to report that he has had under consideration the Statutes of the Legislature of the Province of British Columbia, passed in the eighth year of His Majesty's reign (1918), and received by the Secretary of State for Canada on the 14th day of May last, and he is of the opinion that these Statutes may be left to such operation as they may have.

The undersigned recommends that a copy of this report, if approved, be transmitted to the Lieutenant-Governor of British Columbia for the information of his Government.

Humbly submitted.

(Sgd.) Arthur Meighen,
Acting Minister of Justice.

VICTORIA, B.C.:
Printed by William H. Cullin, Printer to the King's Most Excellent Majesty,
1919.

ANNUAL REPORT

OF THE

MINISTER OF LANDS

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDING 31ST DECEMBER

1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

VICTORIA, B.C., February 28th, 1919.

To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

Herewith I beg respectfully to submit the Annual Report of my Department for the year ending December 31st, 1918.

T. D. PATTULLO,
Minister of Lands.

VICTORIA, February 26th, 1919.

The Honourable T. D. Pattullo,

Minister of Lands, Victoria, B.C.

SIR,—I have the honour to submit the Annual Report of the Department of Lands for the twelve months ending December 31st, 1918.

I have the honour to be,

Sir,

Your obedient servant,

G. R. NADEN,

Deputy Minister of Lands.

PART I.

DEPARTMENT OF LANDS.

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DEPARTMENT OF LANDS.

REPORT OF OFFICE STATISTICS.

February 28th, 1919.

G. R. Naden, Esq.,
Deputy Minister of Lands, Victoria, B.C.

SIR,—I have the honour to submit report of the administration of lands in the Province during the year 1918, namely:—

(1.) Statement showing the number of pre-emption records, certificates of improvement, and certificates of purchase issued:
(2.) Statement of Crown grants issued, divided into different classes, showing the total acreage of Crown-granted pre-emptions, mineral claims, and purchased lands:
(3.) Statement of coal-prospecting licences, coal leases, and sundry leases issued, showing the approximate area thereof and the fees and rentals collected in connection therewith:
(4.) Statement of land-sales, showing the area of surveyed and unsurveyed lands sold:
(5.) Statement of the number of pre-emptions inspected during 1918:
(6.) Statement showing the revenue received by the Lands Branch, Victoria, from various sources:
(7.) Comparative statement of the various land transactions since the year 1906.

I have, etc.,
H. CATHCART,
Superintendent of Lands.

PRE-EMPTION RECORDS, ETC., 1918.

	Pre-emption Records.	Certificates of Improvements.	Certificates of Purchase.
Alberni	6	7	22
Atlin	....	....	....
Cariboo	67	50	14
Cranbrook	14	12	15
Fernie	2	4	2
Fort Fraser	166	58	23
Fort George	215	83	41
Golden	1	6	7
Kamloops	31	5	8
Lillooet	124	48	24
Nanaimo	3	1	3
Nelson	1	7	18
New Westminster	....	....	1
Nicola	15	13	10
Omineca	29	19	17
Osoyoos	7	5	12
Revelstoke	1	1	....
Similkameen	23	12	17
Skeena	16	20	63
Slocan	....	2	16
Stikine	....	....	....
Vancouver	84	23	51
Victoria	3	1	228
Yale	16	2	....
Totals	823	379	592

CROWN GRANTS ISSUED, 1918.

Pre-emptions	552
Purchase	92
"Pre-emptors' Free Grants Act"	155
Minerals	301
"Soldiers' Homestead Act"	338
Town lots	39
Reverted lands	4
Reverted mineral claims	15
Miscellaneous	12
"Coal-mines Act"	1
"School Act"	3
Crown grants written up	1,512
Applications for grants	1,530
Certified copies of counterfoil	6

TOTAL ACREAGE DEEDED.

Pre-emptions	105,981.38
Mineral	13,198.43
Purchase surveyed	13,021.77
Purchase unsurveyed	128,119.82
Total acreage deeded	260,321.40

REPORT ON COAL LICENCES, LEASES, ETC., 1918.

COAL-PROSPECTING LICENCES.

Number of Licences issued.	Licence Fees.	Penalties.	Transfer Fees.	Area.
				Acres.
72	$10,337 50	$1,350 00	$25 00	46,080

COAL LEASES.

Number.	Fees.	Rentals.	Total.	Area.
				Acres.
3	$2,990 00	$21,065 42	$24,055 42	1,510

SUNDRY LEASES.

Number.	Fees.	Rentals.	Total.	Area.
				Acres.
83	$415 00	$33,703 68	$34,118 68	5,914

LAND-SALES, 1918.

	Acres.
Surveyed lands sold	3,373
Total lands sold	3,373

PRE-EMPTIONS INSPECTED IN 1918.

Alberni	...
Atlin	...
Cariboo	4
Cranbrook	163
Fernie	30
Fort Fraser	6
Fort George	24
Golden	58
Kamloops	200
Lillooet	...
Nanaimo	...
Nelson	57
New Westminster	...
Nicola	91
Omineca	...
Osoyoos	51
Revelstoke	13
Similkameen	19
Skeena	...
Slocan	16
Stikine	...
Vancouver	62
Victoria	31
Yale	2
Total	827

STATEMENT OF REVENUE.

Months.	Pre-emption Records.	Records.	Certificate of Improvements.	Crown-grant Fees.	Survey Fees.	Rent of Land.	Search.	Coal-prospecting Licences.	Land-sales.	Miscellaneous.	Total.
January	$2 00	....	$4 00	$ 930 00	$392 25	$5,972 00	....	$3,300 00	$ 21,280 72	$2,201 00	$ 34,081 97
February	....	....	....	1,900 00	471 75	2,780 26	....	500 00	81,675 94	243 55	87,571 50
March	2 00	....	....	2,020 00	125 20	5,017 10	....	650 00	134,769 09	605 17	143,188 56
April	....	....	....	850 00	.....	4,532 71	....	200 00	2,019 25	537 55	8,139 51
May	2 00	....	....	700 00	123 00	6,399 90	....	.....	2,915 90	194 00	10,334 80
June	....	....	....	795 00	.....	5,744 20	....	300 00	1,120 00	236 00	8,195 20
July	....	$6 00	....	1,280 00	470 00	5,449 05	....	200 00	350 16	136 15	7,891 36
August	....	6 00	....	1,040 00	28 75	4,671 80	....	650 00	28,485 41	206 48	35,088 44
September	....	4 00	....	920 00	.....	2,273 02	....	950 00	292 58	118 15	4,557 75
October	....	5 50	....	1,385 00	74 50	7,083 41	....	2,187 50	1,051 21	172 35	11,959 47
November	....	5 50	....	1,185 00	14 25	5,910 85	....	350 00	3,380 15	94 55	10,940 30
December	....	12 05	....	680 00	.....	2,379 80	....	1,050 00	3,272 30	89 50	7,443 65
Totals	$6 00	$39 05	$4 00	$13,685 00	$1,699 70	$58,174 10	....	$10,337 50	$280,612 71	$4,834 45	$369,392 51

SUMMARY.

	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.
Pre-emption records	1,048	936	1,535	1,620	2,049	2,383	3,655	3,855	4,304	2,277	1,167	824	823
Certificates of improve't.	180	262	256	289	439	624	715	962	1,002	665	465	541	379
Certificates of purchase	1,550	3,205	2,438	4,363	9,031	7,141	5,065	3,640	1,805	990	729	778	592
Crown grants	1,124	1,520	1,667	1,714	1,572	2,566	2,757	2,110	1,376	718	847	1,167	1,512
Total acreage deeded	336,145.03	599,419.57	253,541.95	326,229.54	300,587.79	524,325.99	253,143.06	390,036.23	245,244.78	75,225.00	98,452.00	187,111.64	260,321.40
Coal-prospecting licences	286	426	479	692	145	2,223	2,003	1,090	545	198	120	71	72
Sundry leases	294	155	36	83	92	121	47	46	51	38	86	73	83
Coal leases	.....	.....	.....	.....	.....	.....	75	207	71	29	31	7	3
Cash received	$1,230,754 07	$2,088,923 79	$3,065,164 43	$4,148,403 44	$3,190,416 21	$3,526,544 61	$2,525,497 29	$946,944 23	$589,687 36	$126,308 28	$159,213 65	$194,435 17	$369,392 51
Letters received	19,661	29,430	33,629	25,798	37,188	41,946	43,302	31,738	30,287	19,151	13,779	15,780	22,500
Letters sent	.....	.....	.....	.....	.....	23,568	21,612	17,305	14,790	10,104	8,432	12,632	12,500

REPORT OF THE COMMISSIONER OF GRAZING.

November 9th, 1918.

The Deputy Minister of Lands,
Victoria, B.C.

Sir,—During the past two months, which have been spent continuously in the range country of the Province east of the Cascade Divide, certain conclusions have been reached regarding the use and management of the vacant Crown lands available for grazing purposes. These conclusions, while no means definite as to the details of local management in the various districts or as to what will be later known as sectional range units of the area covered, embrace principles of range-management which will be closely followed in the future handling of the open range in the development of the live-stock resources of the Province. I have discussed these matters with the stockmen individually and at various gatherings, and the consensus of opinion is clearly in favour of active and effective control of the grazing ranges by the Government.

Description of Range.

From the view-point of range-management there may be said to be two topographic types of range available for use: (1) The vast area lying between the Fraser River on the west, the Similkameen on the south, and the Rocky Mountains on the east; and (2) the more rugged and mountainous areas outside of the approximate boundaries of the first type mentioned.

The first type approaches more closely what is desired for range cattle than for sheep on account of its comparatively level character and general absence of the luscious, weedy annual plants found on the higher and more moist areas of the rugged and mountainous regions.

In general the forage-growth of the first type includes bunch-grass and blue-grass, with scattering bromes and rye-grasses, as the predominating plants on the lower, more open south slopes, with pine-grasses as the main forage in the timber. Scattered lupines and other weed-plants occur in the timber, but in general the pine-grasses are predominant. Although very nutritious, they are of such coarse character that they afford much better feed for cattle than for sheep. Sheep will do well on such range, but cattle will get much more out of it than sheep, as much waste of forage will usually result when it is grazed by the latter. This waste may to a great extent be overcome by careful and systematic burning, but, nevertheless, the pine-grass is not as suited to the needs of the ewe and lamb as to the cow and calf. The growing lamb matures so much more rapidly than the calf, and therefore requires a more tender ration than the pine-grass affords if it is to make its best and most profitable growth.

Scattered throughout this first general type, however, are many areas of comparatively steeper range which cannot be used to advantage by cattle and which afford excellent range for sheep. In some instances there are areas which will afford range for one or more bands of 1,200 head of old sheep to the band. There are many sections where but one band can be accommodated. Areas of this character are to be found in the vicinity of Brookmere, Clinton, Nicola, Pavilion Mountain, and other places.

In the use of this range, however, the desires of the interested settlers will predominate. Many are interested in cattle and many in sheep; whatever class of stock a man desires to run, he can make a success of his venture with reasonably good management in spite of the fact that the summer range he uses is better adapted to the grazing of one class of stock than to another. The raising of various classes of stock in any section of country will have a broadening influence on the general live-stock education of that section, and a more definite stabilization of its prosperity will result than if its operations were confined to the growing of but one class of stock.

The second or more rugged type of range is, as has been stated, very desirable sheep-range. The lower slopes afford the usual bunch and blue grass; the range of medium height, the pine-grasses; while the upper areas closer to the snow-line produce the weedy annuals so essential to the ewe giving milk for a rapidly growing lamb, which a few weeks after birth is eating freely of the herbage on such range. Above timber-line is found, often in dense growth, many of the palatable, low-growing sedges and grasses which are very desirable on any sheep-range. The many meadows available also produce abundantly, and, while in themselves they could be used perhaps as well by cattle as by sheep, they are more suited to the latter, since sheep can use all or most of the surrounding range and cattle cannot. The wet meadows of the upper ranges are often susceptible to damage by cattle on account of the trampling of the moist soil which is not in evidence in sheep-grazing.

In the use of this type, however, the desires of the settler living adjacent, who will make use of it, must prevail. It will no doubt develop, however, that as the stock industry grows, the use of such range will be divided by agreement between cattle and sheep men operating the ranch property adjacent and dependent upon it.

As in other sections of the continent where similar range is available and is being used, the canyon-bottoms and lower benches are devoted to cattle-grazing and the upper and more rugged slopes to sheep-grazing, with areas of low range set aside for the use of the latter class while passing from the winter to the summer range.

CONDITION OF THE RANGE.

As a general statement, it may be said that the condition of the lower or open bunch-grass ranges is bad, while that of the timbered range is good.

The range such as that of the first type referred to as desirable cattle-range is of such comparatively even elevation that areas of open grass lands producing bunch-grass occur throughout it all and at the highest elevations. As this type is in more or less general use without proper system of control, the open grass areas are heavily grazed during the whole of the open season. The consequence is that the grasses have not had an opportunity for years to mature and they are rapidly weakening in growth each year. In some instances the range is in a sadly depleted condition and will require years of careful management to restore it. In other instances where the use has not been very heavy in the past two or three years, proper protection during the growing season will make for a good growth of grass which will be available for fall grazing. Where heavy overgrazing has resulted in an advanced stage of depletion, it will be extremely advisable to protect the grass entirely during the spring or growing season for several years. But where the damage is not great and good results will follow two or three years' protection in the early part of the season, light grazing in the spring, so that not more than 50 per cent. of the growing plants will be consumed, will not retard restoration seriously.

Bunch-grass plants very much weakened by overgrazing seldom produce seed, the viability of which is sufficient to have a marked influence on the restoration of any area. If the plants are given the chance to make sufficient growth so that plant-food for succeeding years of growth can be manufactured and stored away in the root system, the plant will be strengthened and will rapidly increase in size and strength.

The timbered portions of range on areas which are in general use for grazing are but lightly touched. When grazed it is because the only water available is located in the timber and the bunch-grass or open portions are practically denuded of forage. This is to be expected where no system of range-management is practised, because cattle will naturally congregate and graze on areas upon which is found the most palatable and sweeter forage. The bunch and blue grass of open areas are more palatable and sweeter than the coarser and harsher pine-grasses; consequently the stock will graze the former and slight the latter if not induced to frequent and graze the timbered range.

The correction of this uneven use of range requires systematic co-operation between the stockmen who use it and the Government which controls it. The practical management should ultimately devolve upon the stockmen under the direction and supervision of the Government.

When we speak of the open range, reference is made to that which is used by stock turned out to graze from the time the home or winter range pastures are not in use, or from the opening-up of spring until the snow flies and necessitates the gathering-in of the stock on the winter ranch. This open range must furnish forage for spring, summer, and fall, and in general may be said to consist of spring feed on the lower or open areas consisting mainly of grasses, mid-summer feed in timbered areas made up generally of pine-grasses, weedy annuals, and the rushes and sedges of meadows, and fall feed on areas of low or open grass range protected during the spring in order to afford feed for fall grazing. This is the natural and only feasible division of any range to secure good results, and when the division is made a basis for the correct system of management is laid.

RANGE IMPROVEMENT.

The systematic management of a range, therefore, requires: (1) Its division into spring, midsummer, and fall range as nearly as possible; and (2) the even grazing of stock over its area. The latter case can be accomplished in the case of cattle by: (*a*) The development of

watering-places; (*b*) the correct distribution of salt; and (*c*) the construction of drift or division fences. And in the case of sheep: (*a*) By development of watering-places when necessary; and (*b*) the application and adoption of a grazing plan for each allotment.

All of the ranges examined are not alike in their make-up. Many are ideal; that is, they furnish enough spring and fall range, if properly protected, to balance the midsummer range available. Others are unevenly made up, having, perhaps, too little or too much of spring, midsummer, or fall range, and, as is often the case, the available open range on Crown lands is midsummer range only. They must therefore be managed somewhat differently, although the same principles will apply to all. For example, a range which furnishes only midsummer range and which can only be used during that period without damage resulting to the forage would require that the stock be kept on other lands until the forage is ready for use. Again, a range which had but little true midsummer range of the weed and browse type, but had plenty of the open or actual spring and fall range, would necessitate more grazing on dry range during the summer period than best results in beef or mutton products would ordinarily call for.

The improvement of ranges by water-development contemplates the development of springs and seeps by digging out, fencing, and troughing, so that the water will be evenly distributed over the range, and stock will consequently not have to travel far to and from water. Where watering-places are widely scattered there results heavy grazing near the water and light or no grazing at all at a distance from the water, or, in other words, an uneven use of the range.

This condition can be remedied to some extent by the proper placing of salt on the range, but it is always essential, if the most beneficial results are to follow, to plan for the development of springs and seeps not now affording adequate water for the surrounding range, and in this way cut down the distance of travel between water and salt.

The use of more salt on the open ranges is important, as well as its proper distribution. I find that it is the general practice to throw down the salt at the most convenient place on the range. This is generally along roads and trails, and particularly in the vicinity of water and at places where cattle are in the habit of congregating. Years of such practice has, of course, developed these congregating grounds, so that the habit of hauling the salt to these places year after year is generally well established, with the natural result that overgrazing around the watering-places is well developed, to the injury of the stock and range. There is also a heavy loss of good forage through lack of use of the range at a distance from the water.

In many cases I find this unsystematic use is retarding seriously the development of the stock industry. When but a portion of the range is being used the balance must necessarily be counted out of capacity estimates, and when the used portion is being seriously overgrazed and decreasing in carrying capacity each year there is a tendency to cut down the herds rather than to increase them and slacken up in the hay-producing development of the winter ranches. There are in the aggregate thousands of acres of undeveloped hay lands on a great majority of the ranches which will raise hay sufficient for many thousands more head of stock that can be more than well provided for with summer range. It can be said that the summer ranges of the Province are unlimited so far as they relate to the capacity of the winter ranches.

To develop a correct use of the summer ranges, therefore, all users must realize that the placing of salt in the vicinity of watering-places is a great mistake. Salting-grounds should be established at a distance from the water. An ideal range should have watering-places not more than a mile apart, with salt-troughs between them. Thus the salt-troughs would also be not more than a mile apart, and there would result a quiet feeding between water and salt which would so evenly distribute the cattle that the maximum in improvement and in carrying capacity will be attained. Practice and observation will enable the men in charge of the stock on the range to improve preliminary plans.

The construction of drift and division fences on cattle-ranges is often important, especially on those ranges where the topography permits the wandering of cattle from one division to another or on to adjacent sheep allotments. They are important in that they assist in the round-up by confining the cattle to designated ranges and preventing loss from straying.

The drift-fence is that which marks the exterior limits of the range unit, and the division-fences are those constructed to divide spring or fall from midsummer range, or, perhaps, the beef from the cow range. They are variously used, and in the protection of much of the lower or grass ranges of the Province on the more level types may eventually be very necessary. Areas like the Lumdum and Hamilton Commonages require drift and division fences to make adequate provision for their restoration.

Generally speaking, however, the development of water resources where possible and the correct distribution of salt may be relied upon to bring excellent results in developing a use of the now neglected timber areas and the protection of grass-producing range.

Referring in particular to the use of sheep-range, it may be said that water and adequate plans will accomplish all that is necessary in the protection of the allotments. Sheep are herded and the application of any plans for the use of an allotment should be easy, and little excuse can be made for not following the broad requirements of any plan.

The sheep industry is so small in the Province that but little range has suffered from overgrazing by sheep. As the industry develops and new range is opened up, the chief concern will be the prevention of heavy grazing on areas where herders as a rule find it easy to feed the sheep, and forcing a use of areas supporting excellent feed, but upon which it appears to be more difficult to herd. Each plan as compiled will contemplate, as in the plans for the use of cattle-range, the grazing of low range early, the higher and more remote range in midsummer, and a return to the protected fall range of the lower slopes, alternate grazing on the grass ranges to be practised to ensure maximum production.

ALLOTMENT.

The careful and correct management of the range will require its division between the two principal classes of stock, cattle, and horses in the one, and sheep and goats in the other. Cattle and horses can be more economically and successfully managed in allotted community ranges instead of individual allotments. They are turned loose to graze, and there is always an intermingling of stock on each distinct unit of range, which, for best results, will necessitate co-operative management by the owners of such stock working together as an association.

These associations for range-work may comprise two or more owners. Individual cattle-ranges will not be the general rule, and should not be sanctioned in any plan of range-management unless there is such isolation in evidence that the cattle cannot mix with others and friction over boundary-lines is not possible. Individualism in allotments may be considered so far as the salting and development-work on a portion of a range unit is concerned, but not to the extent of giving one man absolute control of a particular area upon which his neighbour's cattle will stray, and from which his own will drift, that he will feel called upon to complain about drift upon his allotment. Absolute isolation should be apparent before the individual cattle allotment is considered. Where one man is in the habit of turning his cattle on one portion of a range unit and another on a separate portion and they intermingle, the proposed permits should cover in their description permission to use the whole unit, and no friction arising between the users because of rights claimed to any portion of the units should be considered as ground for a just complaint.

In the allotment of sheep-ranges it is evident that applications will come from owners who have small bands of sheep of 200 to 600 head each and on up to 1,200 head to the band. I anticipate that the small flock will be very much in evidence in British Columbia in the future, even in the range country. Where such a condition results the sheepmen will experience difficulty in securing herders for small bands unless they are willing to pay good wages. With a heavy expense in this way, the raising of sheep by those who would like to do so, but who cannot see their way owing to the expense, will be prevented. The Department should therefore encourage the runninng of co-operative bands.

This plan contemplates the setting-aside of adequate allotments for each band of approximately 1,200 ewes with lambs, and encouraging several owners to pool their flocks for the summer. The expense of the herding can then be shared on a *pro rata* basis, the sheep being divided in the fall when they leave the summer range and the losses shared proportionately. Each man can attend to the breeding, wintering, and lambing of his own sheep. In some instances the possibility of running co-operatively, except as to winter feeding, may appeal to the owners, the group owning the necessary rams. Many, of course, probably most of the growers, will prefer to run their sheep apart from others, in which case adequate individual allotments should be provided.

It will be found sheep-ranges must necessarily be set aside within units of ranges of which the majority of users are cattlemen. This can be successfully accomplished by confining the sheep to a distinct allotment, but allowing the cattle to graze over the entire unit, sheep-range and all. The sheepmen will be compensated for this drift by having an adequate allotment.

The sheep being herded can be confined to lines, but the cattle grazing loosely cannot, and it would not be advisable to put the cattlemen to the expense of herding to lines when it is not necessary.

Co-operation.

As stated before, proper management will require co-operation between the Government and the stockmen. Co-operation with individuals regarding individual allotments is brought about through the compilation and application of individual allotment plans.

Co-operation with groups of users, however, will depend upon their organization in an association, with an elected or appointed range committee or advisory board to manage the range in accordance with the suggestions and plans of the Department. The possibilities in this respect are remarkable, and are largely the basis for all progressive work expected to be accomplished in correcting evils in range-management and promoting the general welfare of the stock industry.

Surplus Summer Range.

While I have not yet had an opportunity to examine into this phase of the range question, I have reason to believe there exists in British Columbia very large areas of summer range for sheep in the higher Cascades and in the Rockies which local growers cannot hope to use with local-grown sheep.

It seems clear to me, therefore, that a large field is open to the local man who cares to go outside of the Province in the spring to buy sheep, shipping them in for summer grazing, and thence on to the local or Eastern markets in the fall. This phase of the sheep business has developed in other sections of the continent and will also develop here, and forage resources, which otherwise might be wasted, will be developed and put to profitable use.

Another line of profitable endeavour will develop in the purchase of sheep on the outside and the wintering of them on the heavy-producing hay lands and crops of the Province, and their marketing during the winter months or possibly after shearing in the spring. Many sheepmen who do not care for the expense and hazards of summer grazing on the range will follow this business, which can be made a very profitable one.

Private Lands.

In any system of allotment of the Crown lands the scattered nature of the unfenced private lands will be a factor to be considered. These lands are so numerous within the areas of range used by cattlemen in the more heavily stocked districts that in some cases only a fraction of the range unit is Crown land. This will necessitate a form of permit which may be designated the "on and off permit."

This permit would be issued where the applicant for range does or does not own or control through lease the unfenced private lands in the unit, and the owner of such lands does not object to his use of them. The permit as issued would give permission to graze so many cattle on a unit of range a certain percentage of which is Crown lands.

For example, the percentage of the Crown lands in the unit is fifty, and the applicant desires to graze 100 head of cattle. The permit as issued would cover fifty head of stock, for which he would pay the Government, but should contain a clause reading: "This permit allows the grazing of 100 head of cattle on range 50 per cent. of which is Crown land."

Where the applicant does not own or control the lands and objection is raised to the use of the private lands by the owner or a lessee, the clause would be discontinued and a straight paid permit for fifty head issued, the applicant and the party controlling the private lands settling the use of such lands among themselves without involving the Government.

In all cases where the lands involved are owned or leased by the applicant, the same clause may be included in the permit each season that evidence is filed to prove such ownership or control.

Areas of private lands suitable for grazing may be owned or controlled by an applicant who desires to graze his stock on range at a distance from that in which his private lands are located. If advisable, and he waives the exclusive use of it to the Government and agrees to its use by any one to whom the Government allots it, he could be given a free permit for the number of stock his private lands would carry and be allowed to graze them on an allotment of Crown lands in some other portion of the district, or on the range for which he makes application.

BURNING RANGE.

I have examined many portions of range with the end in view of determining the possibility of the improvement through burning. Many old and recent burns, particularly in lodge-pole pine areas near Clinton, have been examined, and my conclusions at this time are that it will be unwise to undertake severe burning for the purpose of removing the timber.

The stockmen, as a rule, hold the opinion that the lodge-pole or jack-pine areas should be burned, because, as they say, the stock will not eat the pine-grass, which is the principal forage-crop under the pines, and they believe that if the timber is burned the stand will improve on account of the range being more open and exposed and the old grasses, etc., removed. It is true that burning will improve the grass range if wisely done, but it is a mistake to assume that because the pine-grass is not used it is not palatable. It has been pointed out in this report why cattle prefer not to use pine-grass if bunch-grass and other sweeter grasses are available, and it has also been pointed out how cattle can be made to use the pine-grass.

There are very few areas of lodge-pole pine range which cattle are prevented from using on account of the density of the timber. As a general thing, it is not necessary to burn the timber to secure this use. If water is available, the use of salt will accomplish it.

It is clear to me, however, that intelligent burning will assist in a more vigorous growth of pine-grass through the ash-deposit and the removal of the humus with its humic-acid deposit. From a range view-point it destroys the small seedlings which grow and restrict grazing. All burning, however, should be light burning; that is, sufficient only to destroy the old grass without injuring its root system, and to destroy the small seedlings only. The larger trees will be left to grow, thinning themselves out in a natural way, the result being park-like areas of good grazing-grounds, affording the proper shade for cattle in the hot weather, as well as for the character of grasses and forage peculiar to the various lodge-pole or jack-pine ranges.

Indications are that light burning can be accomplished more readily in the early part of the year or about June or early July. It seems unwise, therefore, to consider at this time burning during portions of the year when conditions are such that severe fires will occur and destroy the trees, both large and small. Severe fires seem to destroy the root system of the grass very extensively, and while there is a spotted growth of grass following the fire, in a few years the dead trees fall in until there is an impassable mass of tree-trunks, necessitating a second and even a third burn to open the range again. It would appear useless to burn a second time until practically all dead trees are down.

Observations on second burns in most cases convinces me that severe fires promote the growth of brush, which in a few years grows beyond the reach of the grazing animals. If burning is to be undertaken, it should be light burning only and carried out at a season of the year when only the dead grasses and small seedlings will be destroyed.

It is proposed to burn an area of range north of Clinton next June or July to determine particularly what effect it will have on the growth of the kinnikinic. Instances have been noted where this plant is growing so abundantly that it appears to be having the effect of preventing the growth of palatable forage. White clover and some tame grasses will be sown on a portion of the burn as an experiment.

An area in a 1917 burn near the 59-Mile House was sown with pine-grass to determine the fertility of the soil after a severe fire which in places appeared to destroy all vegetation.

The following tame grasses were sown by Ranger Geo. H. Stevenson on areas of the zone of the 51-Mile fire: Brome-grass and cocksfoot.

It is planned to totally protect portions of these areas to determine the effect of total protection from grazing as compared with the effect of grazing on other portions, and also to find out what will be the result in choking out the tame grasses, if any, by the native herbage under conditions attending total protection, as well as grazing.

Some bunch-grass was sown on a sample area on the Hamilton Commonage as an experiment, and a sample plot was fenced on the Lumdum Commonage to determine the rapidity of recovery of bunch-grass on the most denuded areas of that range.

COYOTE MENACE.

A few of the sheepmen have complained to me that the coyote was a great menace, and that some measure in the way of putting on Government hunters and trappers should be adopted to cope with the evil. Others do not seem to think the coyote is to be greatly feared or to be

considered as an influence sufficient to deter one from entering the sheep business. It is apparent that the man who runs a few sheep or small flock on his ranch and those who use the open range with poor herders in charge are the sufferers. The former does not realize that sheep cannot be allowed to graze under inadequate fences practically without protection in a country where coyotes abound without loss occurring. In such cases the coyote soon becomes familiar with the surroundings and practises on the range and kills sheep whenever he needs a meal. In the latter, careless herding and the bedding of the sheep too long on the same bed-ground is responsible for the loss.

The farm flock should be under a good, well-kept, woven-wire fence. A barbed wire strung along the ground will be very effective in preventing the coyote from digging under the fence. On the range, coyotes can be kept from the sheep if a few shots are fired around the bands during the day and bed-grounds are not established too long at the one place.

I have, etc.,

Thos. P. MacKenzie,

Commissioner of Grazing.

REPORT OF THE SUPERINTENDENT OF BRITISH COLUMBIA SOLDIER SETTLEMENT.

February 24th, 1919.

The Honourable the Minister of Lands,
Victoria, B.C.

Sir,—I have the honour to submit herewith my report of the administration under the "Soldiers' Land Act," being chapter 80 of the Statutes of British Columbia for the year 1918, as required by section 6 thereof. The above Act was assented to on April 23rd, 1918, and my appointment as Superintendent of British Columbia Soldier Settlement dates from September 26th, 1918, approved by Order in Council dated October 8th, 1918, notice of which appeared in the British Columbia Gazette on February 27th, 1919.

Below follows a summary of proceedings under the Act previous to my appointment:—

(1.) By Order in Council approved on June 8th, 1918, and notice appearing in the British Columbia Gazette on June 13th, 1918, the reserve on land covered by Expired Timber Licence No. 33923, situate at Porpoise Bay, near Sechelt, which is about thirty-five miles from Vancouver, which had been subdivided as Lots 4679, 4680, 4681, 4682, 4683, 4684, 4685, 4686, 4687, 4689, and 4690, Group 1, New Westminster District, consisting of eleven parcels ranging in size from about 40 to 60 acres, was cancelled for the purpose of making the same available for soldier settlement. Applications were received between the 14th and 21st days of August, and the allotment of the lands was made on August 29th by drawing. There were twenty-two applicants for this land and eleven records were granted to returned soldiers.

(2.) By Order in Council approved on June 19th, 1918, and notice appearing in the British Columbia Gazette under date of June 26th, 1918, the reserve on land covered by Expired Timber Licence No. 34578, situate at Agamemnon Bay, which is about sixty-five miles from Vancouver and about nine miles from Pender Harbour, which had been subdivided as Lots 4584, 4585, 4586, 4587, 4588, 4589, and 4590, New Westminster District, consisting of seven parcels averaging in size about 40 acres, was cancelled for the purpose of making the same available for soldier settlement. Five applications were received in respect of Lot 4584 and two applications in respect of Lot 4585. No applications were received for the remaining lots, and at the present time the only lot covered by record is Lot 4584.

The requirements as to residence and improvements in connection with these lots were the same as the pre-emption regulations under the "Land Act," except that no fees were charged or will be charged and the land is exempt from taxation under the "Taxation Act" for a period of five years from the date of the record.

While not directly under the "Soldiers' Land Act," an Order in Council was approved on June 26th, 1918, and notice appeared in the British Columbia Gazette on June 27th, 1918, providing that no fees chargeable under the "Land Act" would be collected in respect of a pre-emption record issued under the "Land Act" to a returned soldier as defined by the "Soldiers' Land Act," and also that the land covered by the record should be exempt from

taxes under the "Taxation Act" for a period of five years from the date of the record. This Order in Council is being ratified by an amendment to the "Land Act" now before the Legislature.

It may be noted in this connection that by Order in Council approved on June 4th, 1918, the interest due the Crown in respect of an agreement to purchase town lots held by a person on active service is waived from the date of his enlistment to a date one year after the date of his discharge. This Order in Council is also being ratified by an amendment to the "Land Act" now before the Legislature.

(3.) By Order in Council approved on June 17th, 1918, and notice appearing in the British Columbia Gazette under date of June 27th, 1918, Lots 1346, 1347, 1348, 1349, 2909, and 2910, Kamloops Division of Yale District, comprising an area of approximately 3,800 acres, were reserved for the purposes of the "Soldiers' Land Act." These lands have not yet been opened for soldier settlement and are held pending the completion of survey and the collection of certain data in connection with them.

(4.) By Order in Council approved on August 7th, 1918, and notice appearing in the British Columbia Gazette under date of February 27th, 1919, an area of land situate at the south end of Stuart Lake and extending along the Stuart River was reserved or set aside for settlement by returned soldiers. This land was resurveyed into areas of approximately 160 acres each and comprises a total area of 61,276 acres, being 39,982 acres of first-class land, 16,512 second-class land, and 2,900 acres which has been rated as third-class, also 1,882 muskeg land. The report of the surveyor who performed these surveys is included in the report of the Survey Branch and is published on page 72.

The administration or opening to settlement of these lands is being held in abeyance pending the reaching of a satisfactory agreement between the Province and the Dominion Government in respect of loans to the soldier settlers. It may be that it will be found more advantageous to the soldiers to have this land transferred to the Dominion Government under the authority of the "Soldiers' Land Act," and administered by them through their Soldier Settlement Board. It will, of course, be impossible to complete these arrangements until after the proposed Dominion Legislation becomes law.

Several other areas in different parts of the Province at present under reserve have been examined and are in the process of being examined. With particular reference to logged-off and expired timber licences which have already been subdivided, there are approximately 200 such parcels situate in the Coast districts which will be thrown open for entry in the near future, and the applications of returned soldiers will have preference. Preference is given to the applications of returned soldiers for all lands that are now thrown open for pre-emption entry.

Since my appointment the Government has:—

(1.) By Order in Council approved December 23rd, 1918, and notice appearing in the British Columbia Gazette under date of January 16th, 1919, this Government has acquired from the South Okanagan Land Company, Limited, some 22,000 acres of land situate along the Okanagan River, extending from a point sixteen miles south of Penticton on both sides of the river to the boundary-line, and having an average of two miles in width. This land is acquired with the object of making all or a portion of it available for settlement by returned soldiers.

Owing to the large extent of preparatory work that is necessary in the way of subdividing, building of roads, installing an irrigation system, soil examination and analysis to determine the suitability of various parts of it for different undertakings, it will most likely be the spring of 1920 before it is possible to open this land for settlement. Needless to say, the work of examination and survey is being proceeded with as rapidly as possible under the supervision of the Consulting Engineer of the Lands Department. Returned soldiers are given the preference in employment in connection with all work under the project.

By Order in Council approved on December 14th, 1918, and notice appearing in the British Columbia Gazette under date of December 19th, 1918, Lots 71 and 72, Group 1, New Westminster District, containing 300 acres and situate near Burnaby, were reserved under the "Soldiers' Land Act." The preparation of this land includes the clearing and subdividing, and is receiving the attention of the Department at the present time with a view to making it available in lots of a suitable size for returned soldiers.

While section 6 of the "Soldiers' Land Act" calls for a report of the operations under the Act for the calendar year only, it is worthy of note that:—

(2.) Under Order in Council approved on January 8th, 1919, and notice appearing in the British Columbia Gazette under date of January 16th, 1919, the Government purchased under the "Soldiers' Land Act" from the Municipality of South Vancouver some fifty lots which had reverted to the municipality for non-payment of taxes, for the purpose of providing free homesites and to erect dwellings for returned soldiers, in connection with which, by Order in Council approved on January 13th, 1919, and notice appearing in the British Columbia Gazette on January 23rd, 1919, the following regulations were approved:—

Rules and Regulations Governing the Granting of Homesites and the Building of Dwellings for Returned Soldiers.

1. "Homesites" are residential lots not less titish Columbia soldiers who follow industrial occupurpose of affording free homesites to returned Br also to the dependents of those who have been pations in or near existing centres of industry, andhan 50' x 120' which have been acquired for the killed and to returned soldiers who have been disabled.

2. For the purpose of these rules and regulations the interpretation of "soldier" shall be as set out in subsections (*a*) and (*b*) of section 2 of chapter 80, Statutes of British Columbia for 1918, being the "Soldiers' Land Act."

3. The allotment of homesites shall be made by drawing in a manner to be determined by the Minister of Lands; but priority will be given to the applications of widows and disabled returned soldiers according to the degree of disability or dependents of soldiers who have died in or on account of their service, according to degree of dependency.

4. Each applicant for a homesite shall deposit with his application a fee of $10, which fee should the applicant be successful, will be credited to the first deposit when the contract or agreement is signed, or forfeited should the applicant fail to comply with or enter into the agreement.

5. Should an application for a homesite be refused for any reason the fees paid in connection herewith shall be promptly returned to the applicant.

6. Dwellings of a maximum value of $2,000 will be built on a plan to be selected by the soldier from the approved plans of the Department of Lands on each homesite upon the entering into of a contract or agreement by the successful applicant and the payment of $50 less the $10 already paid as a first deposit, for the payment of the balance by monthly payments as amortized in accordance with the table of the Department of Lands. The said table is based on 5 per cent. interest per annum and a 10 per cent. administrative charge added spread over 20 years. A large initial payment or deposit may be made or any number of instalments of the principal at any monthly date. Should any soldier settler desire to erect a dwelling exceeding $2,000 in value he may do so upon having the plans thereof approved by the Minister of Lands, but the cost of such dwelling in excess of $2,000 shall be met by the soldier settler, the equity of the Government remaining as a first charge against the property.

Facilities will be afforded men possessing the necessary ability to do the individual work themselves under supervision.

7. The first deposit shall be payable within three months from the date of the allotment of the homesite.

8. The soldier settler shall enter into occupation of the dwelling and commence the monthly payments as set out in clause (6) of these regulations on a date not less than thirty (30) clear days after the date of mailing or delivering to him a notice in writing that the dwelling is ready for occupation.

9. When the purchaser has made such payments as shall leave a balance due to the Government equal to the amount charged for the homesite, exclusive of the dwelling, such balance shall be rebated to the purchaser, provided that ten years' residence has been met and all other conditions have been complied with.

10. All dwellings erected on "homesites" shall be insured by the Department of Lands.

The soldier settler shall pay each month in addition to the payment under the amortization table an amount equal to one-twelfth of the premium of the policy or proportion of the policy, as the case may be, insuring his dwelling.

11. Occupation by the settler, personally or by his family, shall constitute residence. Leave of absence may be obtained on application to the Minister of Lands. Two months' absence without the Minister's approval will constitute forfeiture, and all payments theretofore made shall be deemed to be rental paid for occupancy.

12. If it becomes necessary for the settler to move before the contract or agreement has been completed, he may for sufficient reason be permitted to dispose of such land on obtaining the consent of the Minister of Lands. When any homesite is so resold by the Government to another soldier settler the time of residence of the preceding purchaser may in the discretion of the Minister be credited to the subsequent purchaser.

If a sale be made of the said property to any other than a soldier settler the balance remaining unpaid to the Government shall be paid by the purchaser on such terms as may be decided upon by the Minister of Lands, provided that the first payment shall be not less than 25 per cent. of the balance remaining unpaid.

13. Non-compliance with any of the above regulations will forfeit all claim to the property, but the Minister of Lands is hereby empowered to grant such extensions of time for payments as may in his

discretion seem just, and to grant reasonable requests for removal, exchange, or withdrawal according to the merits of each particular case, and to make such disposal or settlement as may be deemed just and equitable.

14. The agreement may contain such other terms and conditions as are considered necessary.

15. Such forms as may be necessary for the information of intending applicants and the proper carrying out of these regulations shall be prepared under the direction of the Minister of Lands.

The following are given as examples of payments:—

Example—House, $1,700, less $50=$1,650. Annual payment, $132.40, or $11.04 per month. Ten per cent. administrative charge=$170, or $8.50 yearly or 71 cents monthly.

End of	Repayment of Principal.	Interest.	Repayment of Principal.
1 year	$ 49 90	$ 82 50	$1,600 10
2 „	52 40	80 00	1,547 70
3 „	55 02	77 38	1,492 68
4 „	57 77	74 63	1,434 91
5 „	60 66	71 74	1,374 25
6 „	63 69	68 71	1,310 56
7 „	66 88	65 52	1,243 68
8 „	70 22	62 18	1,173 46
9 „	73 73	58 67	1,099 73
10 „	77 42	54 98	1,022 31
11 „	81 29	51 11	941 02
12 „	85 35	47 05	855 67
13 „	89 62	42 78	766 05
14 „	94 10	38 30	671 95
15 „	98 81	33 59	573 14
16 „	103 75	28 65	469 39
17 „	108 94	23 46	360 45
18 „	114 38	18 02	246 07
19 „	120 10	12 30	125 97
20 „	126 11	6 20	*Nil.*
	$1,650 14	$997 86	.....

Amortized payment	$11 04
Administration	71
Total monthly payment	$11 75

Example—House, $1,870, less $50=$1,820. Annual payment, $146.04, or $12.17 per month. Ten per cent. administrative charge=$187, or $9.35 yearly or 78 cents monthly.

End of	Repayment of Principal.	Interest.	Balance of Principal.
1 year	$ 55 04	$ 91 00	$1,764 96
2 „	57 79	88 25	1,707 17
3 „	60 69	85 35	1,646 48
4 „	63 74	82 30	1,582 74
5 „	66 89	79 15	1,515 85
6 „	70 24	75 80	1,445 61
7 „	73 74	72 30	1,371 87
8 „	77 44	68 60	1,294 43
9 „	81 34	64 70	1,213 09
10 „	85 39	60 65	1,127 70
11 „	89 60	56 40	1,038 10
12 „	94 14	51 90	943 96
13 „	98 84	47 20	845 12
14 „	103 79	42 25	741 33
15 „	108 99	37 05	632 34
16 „	114 44	31 60	517 90
17 „	120 14	25 90	397 76
18 „	126 14	19 90	271 62
19 „	132 44	13 60	139 18
20 „	139 18	6 86	*Nil.*
	$1,820 00	$1,100 76	.....

Amortized payment	$12 17
Administration	78
Total monthly payment	$12 95

These homesites were opened to application for two weeks previous to February 10th, 1919, at the office of the Government Agent at Vancouver, and on February 20th homesites (double lots) were allotted to fourteen applicants. As soon as possible after the plans are selected, construction of the dwellings will proceed under the direction of the Public Works Department.

While not under the jurisdiction or administration of the "Soldiers' Land Act," the following items should be noted in this report:—

(*a.*) Lands in the settlement areas in the Bulkley and Nechako Valleys have been opened for sale by the Land Settlement Board, and in the case of the purchaser being a returned soldier he is allowed a rebate of $500 on the purchase price. Up to the present eight parcels in the Bulkley and five in the Nechako have been purchased by returned soldiers.

(*b.*) Pre-emption records issued under the "Land Act" to returned soldiers since September 1st to date are as follows:—

Land Recording Division—

Ashcroft	1
Clinton	1
Fairview	2
Fort Fraser	1
Fort George	2
Hazelton	2
Kamloops	2
Nanaimo	1
Prince Rupert	2
Quesnel	1
Vancouver	19
Total	34

(*c.*) Under the "Pre-emptors' Free Grants Act" and amendments, 248 free Crown grants of their respective pre-emptions have been issued to returned soldiers.

(*d.*) Under the "Relief Act," which is administered by the Department of Lands, on receipt of an application for relief in respect of the fees of a coal and petroleum licence or lease in the name of a man on active service I find it is the practice to recommend to the Executive Council that all fees in connection therewith be stood over for a period ending six months after the end of the present war.

(*e.*) Under the "Forest Act Relief Act," administered by the Forest Branch, a man on active service is exempt from the payment of annual fees on timber licences until six months after the end of the present war, when payment without interest or penalties is to be made.

In the amendments proposed this year it is provided that the back payments can be made in instalments beginning on the first annual renewal date six months after the termination of the present war.

I wish to extend my best thanks to my staff, which is composed of an assistant (J. Mavor, a previous official in the Lands Department, recently returned from France) and two stenographers.

I have, etc.,

J. W. CLARK,

Superintendent, B.C. Soldier Settlement.

PART II.

SURVEY BRANCH.

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REPORT OF THE SURVEYOR-GENERAL.

The Hon. T. D. Pattullo,
Minister of Lands, Victoria, B.C.

SIR,—I have the honour to submit the following report of the Survey Branch of the Department of Lands for the year ending December 31st, 1918:—

The appropriation for Crown land surveys for the current year was $70,000, being lower than that for any year since 1907. In consequence it has been necessary to further curtail field operations and to confine the work to only the most necessary surveys.

As in the previous year, the greater portion of the field-work was confined to the survey of lands already held under pre-emption record. Among these are included records held by men in military service, who will be entitled, on discharge from the army, to free grants under the provisions of the "Pre-emptors' Free Grants Act." As the amendment to the "Land Act" of 1918 has abolished the pre-emption of unsurveyed land, it has been possible to survey this year a large proportion of the unsurveyed land held under pre-emption record, and in another year it will probably be possible to survey practically all such lands, which are more or less close to transportation, leaving only the isolated parcels which the Department does not propose to survey, and the owners of which will necessarily be required to have surveyed by private arrangement with the surveyor. It will be seen, therefore, that with practically all timber licences and pre-emptions surveyed and outstanding applications to purchase cancelled, there should be at the end of 1919 very few unsurveyed alienations on record in the Department.

This condition will considerably facilitate the administration of Crown lands, and avoid many complications due to conflicting interests which this Department has been called upon to deal with in the past.

The work of triangulating and traversing portions of the coast-line has also been continued. This work was commenced in 1916 and continued in 1917 and 1918, on account of the numerous applications for timber-sales and hand-logger licences along the Coast. The Admiralty charts which constituted practically the only information available with regard to the greater portion of the coast-line were found to be in many instances not sufficiently reliable for our purposes. The fact that the end of a large inlet was found this year to be about twelve miles out of place on the chart is quoted as an example of the necessity for this work. The work in the field consists of triangulations between points on opposite sides of inlets and tying in the corners of existing surveys. Where triangulations are impracticable, stadia traverses are resorted to. While this method does not give accurate details as to the sinuosities of the shore-lines, it is sufficient for our purposes, and has the advantage of furnishing the greatest amount of necessary information at a minimum cost.

The scheme of continuity in this work prepared in the spring was unfortunately interfered with to some extent by a drowning accident, in which J. E. Laverock, B.C.L.S., in charge of a party, and one of his assistants, J. Griffiths, lost their lives in Dean Channel.

Mr. Laverock and Mr. Griffiths were last seen on August 31st, on their way from Ocean Falls to the survey camp, and it is presumed that their boat was overturned in the storm which prevailed on the Coast that day. Mr. Laverock had been employed on Government work annually for several years, and his field-work and returns were always highly satisfactory. It is felt that his unfortunate and untimely death has removed one of the most efficient men of his profession in the Province.

Specially reserved lands for returned soldier settlement were surveyed in the vicinity of Merritt and at Stuart Lake. In the former locality twelve parcels containing 1,770 acres were surveyed. At Stuart Lake a large area of lands which reverted to the Crown under the provisions of the "Soldiers' Homestead Act" were subdivided into parcels of 160 acres approximately. About 61,000 acres of land were thus made available for soldier settlement. Detailed reports on these areas will be available in due course.

The surveys for the year include 283 parcels under pre-emption record, 68 parcels of Crown land, and 387 miles of coast-line traverse.

This must be considered satisfactory considering the adverse conditions prevailing during the season, such as the unusually wet weather in July in certain portions of the Province, the difficulty in obtaining competent and experienced labour, and the necessity of a large amount of moving from one piece of work to another.

The following is a summary of the field operations carried out during the season in the various portions of the Province:—

CENTRAL AND NORTHERN INTERIOR.

For the purposes of this report the Central and Northern Interior are defined as that portion of the Province lying north of the Dominion Government Railway Belt and east of the Cascade range of mountains. Ten surveyors were employed in this portion of the Province in the localities indicated:—

A. J. Campbell .....Swan Lake, Peace River District.
H. C. Black .....Rose Lake, Coast District, Range 5.
F. P. Burden .....Moose Springs, Cariboo District.
R. W. Haggen .....Fraser River Valley, between Quesnel and Chimney Creek, Cariboo District.
F. Butterfield .....Horsefly River and Quesnel Lake, Cariboo District.
F. Tupper .....North-western Lillooet District.
W. S. Drewry .....Eastern Lillooet District.
G. S. Boulton .....Anderson and Seton Lakes, Lillooet District.
W. G. McElhanney .....Upper North Thompson River, Kamloops District.
J. E. Ross .....Lower North Thompson River, Kamloops District.

SOUTHERN INTERIOR.

In that portion of the Province lying south of the Canadian Pacific main line of railway five parties were employed, as follows:—

F. H. Latimer .....White Valley, Osoyoos District.
B. A. Moorhouse .....Vicinity of Summerland, Osoyoos District.
C. A. E. Shaw .....Vicinity of Fairview, Similkameen District.
O. B. N. Wilkie .....Vicinity of Merritt, Kamloops District.
P. W. Gregory .....Vicinity of Princeton, Kamloops District.

Practically all the arable lands in this portion of the Province have been surveyed. The work this year consisted principally of the survey of pre-emptions located on the outskirts of the valleys, and while they contain some land which can be brought under cultivation, the majority of them contain a large proportion of high bench or more or less steep hillside. Being situated in the Dry Belt and, generally speaking, at too great an elevation for irrigation, these pre-emptions are generally conceded to be suitable only for the raising of a limited amount of stock, commensurate with the amount of winter feed which the pre-emptor may be able to grow in those portions of his land which can be cultivated, and possibly, if fortunate enough in location, augmented by wild meadow-hay.

Mr. Wilkie also surveyed into suitable parcels some lands a short distance south-west of Merritt, which have been reserved for returned soldier settlement.

MAINLAND COAST.

Five surveyors were employed on the Coast between Vancouver and Prince Rupert, as follows:—

H. H. Roberts.....Cortes and Redonda Islands, etc., New Westminster and Coast Districts.
Jno. Elliott.....Queen Charlotte Sound, Coast District, Range 2.
C. C. Smith.....Rivers Inlet and Burke Channel, Coast District, Ranges 2 and 3.
J. E. Laverock.....Dean Channel, Coast District, Range 3.
A. E. Wright.....Cumshewa Inlet, Queen Charlotte Islands District, and Roscoe Inlet, Coast District, Range 4.

Mr. Roberts's work consisted mainly of pre-emption surveys, and Mr. Elliott surveyed a few pre-emptions at Blunden Harbour after traversing the north shore of Queen Charlotte Sound

from where he left off work last year to a point where a previous traverse had been carried to from the North.

Messrs. Smith, Laverock, and Wright were employed exclusively on triangulation and the traverse-work in various inlets, and considerable progress was made on this work.

MISCELLANEOUS SURVEYS.

L. S. Cokely was employed on small scattered surveys on Vancouver Island, the Lower Mainland, and Gulf Islands.

TOPOGRAPHICAL SURVEYS.

The photo-topographical survey of the Okanagan Lake basin, which was completed in 1917, was this year extended to cover the eastern watershed of Okanagan River between Penticton and the International Boundary, including the greater portion of the lands recently purchased by the Crown for development with a view to soldier settlement. An area of about 325 square miles was covered and the mapping of this work is now being proceeded with. R. D. McCaw has, as in former years, been in charge of this work.

ALBERTA-BRITISH COLUMBIA BOUNDARY.

The Commission appointed in 1913 for the definition of the boundary between the Provinces of Alberta and British Columbia continued operations during the year; A. O. Wheeler, the British Columbia Commissioner, working in the vicinity of Howse Pass, and Mr. Cautley, representing both the Alberta and Dominion Governments, established a portion of the 120th meridian of longitude in the vicinity of Swan Lake, Peace River District.

The report of the Commission for the survey of that portion of the boundary between Kicking Horse Pass and the International Boundary was published during past years, having been prepared under the direct supervision of the Surveyor-General of Dominion Lands at Ottawa.

SURVEYOR'S REPORTS.

The general reports of the various surveyors employed during the season are appended to this report.

PRIVATE SURVEYS.

Surveys of Crown lands made at the instance of and paid for by private parties, such as surveys of pre-emptions, applications to purchase or lease, coal licences, timber licences, mineral claims, etc., are known departmentally as "private surveys." There has been a decrease in surveys of this nature from year to year since 1912, and the past season shows a decrease from 1917 in all classes of this nature, with the exception of mineral-claim surveys, which again show a small increase.

With reference to timber-licence surveys, the Statute provides that all licences must be surveyed by November 30th, 1919, leaving only one surveying season for the survey of the remaining unsurveyed licences. According to the Chief Draughtsman's report, there are 3,006 licences reinstatable under the "Forest Act" and amending Acts, and which are still unsurveyed. It is anticipated, however, that only a comparatively small fraction of these are likely to be surveyed, as a large number are known to be of no value as timber holdings owing to faulty location by the original applicants.

OFFICE-WORK.

The details of the work of the office are covered by the report of the Chief Draughtsman submitted herewith.

The organization of the staff has been maintained with very few changes during the year. The end of the war and the return of those members of the staff who have been serving in the Army will, however, necessitate some changes and reorganization during the coming year. It is gratifying to know that of the twenty-three members of this staff who enlisted, not one was called to pay the supreme sacrifice, and only four or five, as far as known at present, have been casualties.

Enlistments during the war almost depleted the staff formerly employed on geographic work, and only two men have been available for mapping during the past two years. However, as the demand for maps fell off somewhat during the war and as less field-work was being done, it has been possible to fill the most urgent requirements in this connection. Many of our maps

are now, however, getting out of date and out of print, and with the return of peace and increasing demand for maps of all descriptions it will be necessary to again increase our facilities for map production.

The most important map completed during the year is one of the northerly portion of Vancouver Island, which is now in the hands of the printers and will be available for distribution shortly. This map, on the scale of four miles to an inch, will show all surveys as well as geographic information, and will include a large portion of the Mainland adjacent to this portion of Vancouver Island, as well as the intervening smaller islands.

It will fill a long-felt want, as the area covered has hitherto been only more or less indifferently mapped. It is hoped also to republish shortly a new edition of the map of southerly Vancouver Island, published in 1913. On the completion of this work the mapping requirements as far as Vancouver Island is concerned should be satisfied for some years to come.

GENERAL.

In my report for the year ending December 31st, 1917, I ventured to predict that the work of the Branch would show a considerable increase during 1918. While the statistics would appear to show that this prediction has not eventuated to any appreciable extent as far as the routine work of the office is concerned, the special work of various natures dealt with during the year would indicate considerable expansion, which will be reflected in the next annual report of this Branch.

The recent successful conclusion of the great world war prompts me to here pay a tribute to the part played by British Columbia land surveyors in the great military struggle. According to available information, 122 surveyors enlisted for overseas service during the war. Of these, twenty-three have laid down their lives, two have been prisoners in Germany for about three years, and many others will return with wound stripes.

The rapid promotion of many of these men, in some instances from the ranks, is evidence that the contribution of the profession of land surveying from British Columbia to the nation's cause was one of quality as well as quantity.

I have the honour to be,
Sir,
Your obedient servant,
J. E. UMBACH,
Surveyor-General.

REPORT OF THE CHIEF DRAUGHTSMAN.

December 31st, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report on the work of the Survey Branch for the year ending December 31st, 1918:—

OFFICE-WORK.

The general work carried out has been similar to that done in previous years, while the volume of work handled has been about the same as that in 1917. At the present date the staff numbers twenty-eight in all. During the year three men resigned and one man enlisted. A returned soldier formerly in the Department was taken on the staff and one junior was appointed.

FIELD-NOTES.

During the year 762 field-books were received, containing notes for 766 lots. During the same period 1,346 lots were plotted and gazetted. Tracings of these lots were prepared and forwarded to the Government Agents in whose districts they were located.

The following table gives an analysis of the acreages of the various kinds of surveys gazetted during the year:—

	Acres.
Pre-emption surveys	10,835
Purchase surveys	1,634
Mineral-claim surveys	9,247
Timber-licence surveys	223,768
Coal-licence surveys	953
Lease surveys	2,342
Government surveys	60,311
Total	309,090

A comparison of these figures with those of previous years, as far back as 1900, may be found by reference to Table A attached to this report. It will be noted that there has been a fair increase over the year 1917 in the number of mineral surveys dealt with.

Table B attached to this report shows that proportion of Government surveys made in relation to the total land surveys for each year since 1900.

Timber Surveys.

Field-notes covering the survey of 296 licences were received during the year, as compared with 424 during 1917. It is estimated that of the timber licences in good standing, or renewable under the Statute, 10,687 have been surveyed, leaving 3,006 still unsurveyed.

Railway Plans.

During the year plans covering 290 miles of railway right-of-way have been finally dealt with and cleared for Crown-granting purposes.

Clearances.

As in previous years, clearance reports have been furnished by this Branch on all applications for lands dealt with by the Lands Department. These include 823 applications for pre-emptions and 12 applications to purchase. The corresponding figures for 1917 were 822 and 19 respectively. These applications, together with those dealt with by the Forest Branch, including 226 timber-sales, are all plotted and noted on the departmental reference maps. Suitable notations are also made on these maps as to the cancellation of pre-emptions, applications to purchase, timber-sales, etc.

Departmental Reference Maps.

The work of keeping these maps up to date and compiling new ones has been proceeded with as heretofore. Ten maps were recompiled and drawn on projection, while one was retraced. The method of compiling these maps on projection enables the joining-up of adjacent maps to be made correctly, and avoids overlapping and at the same time adds greater accuracy to the map itself.

Information supplied to Surveyors and others.

A nominal charge is made for the preparation of copies of field-notes, blue-prints, etc., required by surveyors and others. The revenue derived from this source amounts to $1,479.82, as compared with $1,327 for 1917. This work entailed the copying of 150 sets of field-notes, 1,171 tracings, and 950 letters.

The following is a statement of the number of blue-prints made:—

Mail and counter orders	1,496
Surveyor-General's Branch	1,400
Forest Branch	6,425
Other branches of Government service	6,795
Sundry	2,210
Total	18,326

There were also prepared 1,512 tracings (in duplicate) to be attached to Crown grants, and 84 tracings (in duplicate) to accompany land leases.

CORRESPONDENCE AND ACCOUNTS.

During the year 2,465 letters were received and 2,350 sent out, which does not include interdepartmental memoranda.

Accounts amounting to $75,038.47 have been checked and dealt with by the Accountant.

Table C attached to this report gives a summary of the office-work for the year 1918 and comparative figures for 1917.

WORK DONE FOR THE WATER RIGHTS BRANCH.

The chief work done in this connection includes the clearance of 257 applications, the preparation of plats for 334 conditional licences, and 633 Board orders. In addition, 30 revised water-rights maps have been redrawn and a new set of reference maps statused to show all the water reserves, water rights, and miscellaneous applications.

WORK DONE FOR THE FOREST BRANCH.

The general draughting-work for this Branch has occupied practically the whole time of one draughtsman. The chief work done has been in connection with aeroplane-spruce permits, and has included more or less clerical work. In addition, a portion of the draughtsman's time has been occupied in the compilation of 40-chain-to-the-inch maps for the use of the Grazing Commissioner.

GENERAL.

In addition to the above, the preparation of instructions for both Government and private surveys, including the copying of information from official records, forms a considerable portion of the work of this office.

As in previous years, the staff has also been called upon to attend to various draughting-work for other departments of the Government.

During the year a "photostat" was installed in the Department, which enables the reproduction in facsimile of all kinds of plans, field-notes, documents, etc., and is available for work of this nature for all departments.

The limit of size of prints is 18 x 22 inches. The limit of enlargement is about 2 to 1, and the limit of reduction is governed only by the nature of the original. The machine turns out copies with the work in white on a black background. By a second operation the work comes out black on a white background.

In connection with the above machine, it was found necessary to construct a dark room, which room is available for other work of a photographical nature, and it has been found possible to make enlargements of the photographs taken in connection with the photo-topographical survey carried out during the year. These enlargements were formerly made elsewhere at a considerably greater expense.

The work in connection with this machine occupies practically the whole time of one of the members of the staff, and after its utility becomes more generally recognized it will no doubt require the undivided services of one man.

GEOGRAPHIC SUB-BRANCH.

As in 1917, only two draughtsmen have been available for the compilation and preparation of maps for reproduction by lithography during the past year. Only one map was actually published during the year—namely No. 3E, known as the "Peace River Pre-emption Sheet."

The compilation of Map No. 2C, "Northerly Vancouver Island," was completed and is now in the hands of the printer.

Corrections to Map 2A, "Southerly Vancouver Island," were made, and it is hoped to republish this map very shortly.

A reissue of Map 3L, "Graham Island, Queen Charlotte Islands Pre-emption Sheet," is also in the hands of the printer.

Sketch-maps for the preparation of blocks were also prepared for the Mines Department and Lands Settlement Board. In addition, the above Branch supervised the publication of a small map of British Columbia to accompany Bulletin No. 23.

Of the various lithograph maps available for distribution by this Department, some 14,726 were issued during the past year.

A list of lithograph maps and a list of departmental reference maps are attached to this report as Tables D and E respectively.

I have, etc.,
F. O. MORRIS,
Chief Draughtsman.

APPENDIX TO REPORT OF CHIEF DRAUGHTSMAN.

TABLE A.—SHOWING ACREAGES OF EACH CLASS OF SURVEYS GAZETTED EACH YEAR SINCE 1900.

Year.	Pre-emptions.	Purchases.	Mineral Claims.	Timber Limits.	Coal Licences.	Leases.	B.C. Govt. Surveys.	Totals.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
1900	22,873	4,419	33,441	59	.....	664	10,057	71,513
1901	26,493	16,401	33,400	2,027	.....	593	.....	79,094
1902	35,297	29,652	31,057	1,040	626	1,026	.....	98,698
1903	37,615	26,787	18,115	127,992	....	2,003	800	213,312
1904	48,124	36,468	20,549	155,279	48,670	3,009	179	312,278
1905	42,660	58,705	15,535	214,841	137,218	806	107	469,872
1906	33,573	66,668	9,894	77,829	41,312	9,566	.....	238,842
1907	50,460	162,218	10,017	83,016	20,367	4,387	113,968	444,433
1908	66,788	147,980	14,607	167,925	9,821	2,580	97,072	506,773
1909	71,316	145,325	10,744	426,121	8,310	15,239	512,373	1,189,428
1910	79,273	455,356	12,499	509,201	43,363	5,864	302,536	1,407,912
1911	89,485	1,352,809	21,325	686,909	120,938	6,500	948,644	3 226,610
1912	99,461	1,011,934	16,645	804,730	99,236	8,560	826,362	2,866,997
1913	55,202	508,062	18,043	1,181,355	72,719	4,740	1,014,366	2,854,487
1914	45,551	234,580	7,546	1,105,635	36,098	4,209	1,078,579	2,512,198
1915	22,746	41,551	8,339	512,628	29,245	841	705,170	1,320,520
1916	14,335	8,771	7,677	302,903	10,983	5,145	124,953	474,767
1917	12,632	802	8,386	275,538	2,843	2,960	111,256	414,417
1918	10,835	1,634	9,247	223,768	953	2,342	60,311	309,090

TABLE B.—SHOWING PROPORTION OF GOVERNMENT SURVEYS TO TOTAL LAND SURVEYS SINCE 1900.

Year.	Total Surveys.	Govt. Surveys.	Proportion of Govt. Surveys to Total.
1900 to 1906	907,373	11,143	0.012
1907 to 1911	4,901,984	1,974,593	0.403
1912	2,062,267	826,362	0.401
1913	1,673,132	1,014,366	0.606
1914	1,415,186	1,078,579	0.762
1915	807,892	705,170	0.872
1916	171,864	124,953	0.727
1917	138,879	111,256	0.801
1918	85,322	60,311	0.707

TABLE C.—SUMMARY OF OFFICE-WORK FOR THE YEAR 1918 AND COMPARATIVE FIGURES FOR 1917.

	1917.	1918.
Number of field-books received	914	762
„ lots surveyed	1,083	766
„ lots gazetted and tracings forwarded to Government Agents	1,497	1,346
„ miles of right-of-way plans received	73.5	290
„ applications for purchase cleared	19	12
„ applications for pre-emption cleared	822	823
„ reference maps compiled	10	10
„ Crown-grant applications cleared	1,167	1,512
Total number of letters received by Branch	3,893	2,465
„ „ Crown-grant and lease tracings made in duplicate	1,187	1,593
„ „ blue-prints made	10,435	18,326
Total revenue from information, blue-prints, maps, etc.	$1,327.00	$1,479.82

TABLE D.—LIST OF LITHOGRAPHED MAPS.

Map No.	Year of Issue.	Title of Map.	Scale.	Per Copy.	Per Dozen.
		GEOGRAPHIC SERIES—			
1A	1912	British Columbia. In four sheets. Showing roads and trails, railway systems, etc.	17.75 m. to 1 in.	$1 00	$10 00
1B	1913	British Columbia. In one sheet. Showing Land Districts	30 m. to 1 in.	25	2 00
1C	1913	British Columbia. In one sheet. Showing Land Recording Divisions	30 m. to 1 in.	25	2 00
1D	1913	British Columbia. In one sheet. Showing Mining Divisions (Amended 1917)	30 m. to 1 in.	25	2 00
1E M	1915	Kootenay, Osoyoos, and Similkameen. Showing Mining Divisions	7.89 m. to 1 in.	25	2 00
1E R	1915	Kootenay, Osoyoos, and Similkameen. Showing Land Recording Divisions	7.89 m. to 1 in.	25	2 00
1F	1915	British Columbia. In one sheet. Showing Electoral Divisions	30 m. to 1 in.	25	2 00
1G	1916	Cariboo and Adjacent Districts. Showing Land Recording Divisions	7.89 m. to 1 in.	25	2 00
1H	1917	Northern British Columbia	17.75 m. to 1 in.	25	2 00
		LAND SERIES—			
†2A	1913	Southerly Vancouver Island	4 m. to 1 in.	25	2 00
2B	1914	New Westminster and Yale Districts	4 m. to 1 in.	25	2 00
2C	1919	Northerly Vancouver Island	4 m. to 1 in.	25	2 00
		PRE-EMPTORS' SERIES—			
3A	1916	Fort George	3 m. to 1 in.	Free	1 00
3B	1917	Nechako	3 m. to 1 in.	Free	1 00
3C	1914	Stuart Lake	3 m. to 1 in.	Free	1 00
3D	1915	Bulkley Valley	3 m. to 1 in.	Free	1 00
3E	1918	Peace River	4 m. to 1 in.	Free	1 00
3F	1915	Chilcotin	3 m. to 1 in.	Free	1 00
†3G	1915	Quesnel	3 m. to 1 in.	Free	1 00
3H	1915	Tete Jaune	3 m. to 1 in.	Free	1 00
3J	1917	North Thompson	3 m. to 1 in.	Free	1 00
3K	1915	Lillooet	3 m. to 1 in.	Free	1 00
3L	1919	Graham Island, Queen Charlotte Islands	3 m. to 1 in.	Free	1 00
3M	1916	Prince Rupert	3 m. to 1 in.	Free	1 00
		DEGREE SERIES—			
*4A	1912	Rossland Sheet	2 m. to 1 in.	$0 10	..
*4B	1912	Nelson Sheet	2 m. to 1 in.	10	..
*4C	1912	Cranbrook Sheet	2 m. to 1 in.	10	..
4D	1913	Fernie Sheet	2 m. to 1 in.	10	..
4E	1913	Upper Elk River Sheet	2 m. to 1 in.	10	..
4F	1913	Duncan River Sheet	2 m. to 1 in.	10	..
4G	1914	Windermere Sheet	2 m. to 1 in.	10	..
†4H	1915	Arrowhead Sheet	2 m. to 1 in.	10	..
		TOPOGRAPHICAL SERIES—			
5A	1916	Omineca and Finlay River Basins, Sketch-map of	5 m. to 1 in.	25	2 00
		MISCELLANEOUS—			
48	1913	Sayward District, Sketch-map of	3 m. to 1 in.	10	..
33	1912	Yale District and Portion of Adjacent Districts	8 m. to 1 in.	25	2 00
27	1912	Rupert and Coast Districts, Portions of	3 m. to 1 in.	10	1 00
22	1912	Northern Interior	17.75 m. to 1 in.	10	1 00
18	1912	British Columbia, South-west Portion of. (Second iss.)	12 m. to 1 in.	25	2 00
9	1907	Northern Interior. (A. G. Morice.)	10 m. to 1 in.	10	50
7	1903	British Columbia. In two sheets	20 m. to 1 in.	..	5 00
5	1898	Kootenay District, East, Triangulation Survey of	6,000 ft. to 1 in.	10	50
4	1897	Osoyoos District, Portion of	2½ m. to 1 in.	10	50
3	1897	Kootenay District, West Division, and Part of Lillooet, Yale, etc., Mining Recording Divisions	8 m. to 1 in.	10	50
2	1896	Kootenay District, West, Portion of	1 m. to 1 in.	10	50
1	1895	Vancouver Island, West Coast, Portion of; Clayoquot District	½ m. to 1 in.	10	50

† In course of recompilation. * Out of print.

NOTE.—To avoid misunderstanding, applicants for maps are requested to state the "Map Number" of map desired.

Table E.—Departmental Reference Maps.

Price-list of Blue-prints.

		Scale.	Price
1.	West Coast, V.I. (Barkley Sound, Southerly)	1 inch to 1 mile	$1 00
1A.	West Coast, V.I. (Barkley Sound, Northerly)	" "	1 00
2.	West Coast, V.I. (Nootka District)	" "	1 00
3.	Belize and Seymour Inlets	" "	1 00
3A.	Quatsino Sound and West Portion of Rupert District	" "	1 00
3B.	Gilford, Cracroft, and Broughton Islands	" "	1 00
3C.	Nimpkish River Valley and Lake	" "	1 00
3D.	Central Portion of Rupert District	" "	1 00
4.	Knight, Bute, and Toba Inlets	" "	1 50
4A.	Sayward District, Thurlow, Valdes, and Redonda Islands and Powell Lake	" "	1 00
5.	Texada Island and West Portion, New Westminster District	" "	1 00
5A.	Jervis and Sechelt Inlets	" "	1 00
5B.	Howe Sound and Cheakamus River Valley	" "	1 00
5C.	Harrison Lake and Lillooet River Valley	" "	1 00
6A.	Nicola District	" "	1 00
6B.	Princeton and vicinity	" "	1 00
6C.	Ashnola and South Similkameen River Valleys	" "	1 00
7.	North Okanagan and Mabel Lake	" "	1 00
7A.	South Okanagan Lake and Kettle River Valley	" "	1 00
7B.	Similkameen District (Keremeos, Fairview, and Greenwood)	" "	1 00
11.	Clearwater and Murtle River Valleys	" "	1 00
11A.	North Thompson River Valley	" "	1 50
12	Dean and Burke Channels and Rivers Inlet	½ inch to 1 mile	1 50
12A.	Bella Coola Valley	1 inch to 1 mile	1 50
14.	Banks and Pitt Islands and vicinity	" "	1 00
14B.	Gardner Canal and vicinity	½ inch to 1 mile	1 00
15.	Moresby Island, Northern Portion	1 inch to 1 mile	1 00
15A.	Moresby Island, Southern Portion	½ inch to 1 mile	1 00
16.	Graham Island, North-east Portion	1 inch to 1 mile	1 00
16A.	Graham Island, South-east Portion	" "	1 00
16B.	Graham Island, West Portion	" "	1 00
17.	Portland Canal and Observatory Inlet	" "	1 00
17A.	Skeena River Valley (Mosquito Creek to Kispiox River)	" "	1 00
17B.	Nass and Kitwancool River Valleys	" "	1 00
18A.	Tete Jaune Cache and Upper Fraser River Valley	" "	1 00
19.	Lower Skeena and Zymoetz River Valleys	" "	1 00
19A.	Skeena and Kitsumgallum River Valleys	" "	1 00
19B	Prince Rupert, Mouth of Skeena and Nass Rivers	" "	1 00
20.	Bulkley River Valley (Hazelton to Moricetown)	" "	1 00
21A.	Fraser Lake and Nechako Valley	" "	1 00
21B.	Francois and Ootsa Lakes	" "	1 00
21C.	Douglas Channel and Kildala Arm	" "	1 00
22.	Bowron River and Upper Fraser River Valley	" "	1 50
22A.	Fort George and vicinity	" "	1 00
22B.	Portion of Nechako River Valley and Cluculz Lake	" "	1 00
22C.	Blackwater and Mud River Valleys	" "	1 00
22D.	Fraser River Valley, vicinity of Quesnel	" "	1 00
22E.	Goat River and Upper Fraser River Valleys	" "	1 00
23.	Quesnel Lake (East Arm)	½ inch to 1 mile	1 00
23A.	150-Mile House, Barkerville and Quesnel Lake	1 inch to 1 mile	1 50
24A.	Anderson and Seton Lakes, Lillooet District	" "	1 50
24B.	Lillooet District (Clinton, Big Bar, and Bridge River Valley)	" "	1 50
25.	Mainland Coast, Hecate Island to Princess Royal Island	" "	1 00
26.	Porcher and Adjacent Islands	" "	1 00
27.	Fraser River Valley (Williams Lake, Soda Creek, and Alexandria)	" "	1 00
27A.	Fraser and Chilcotin River Valleys, Dog Creek	" "	1 00
27B.	Lac la Hache and Northern Lillooet	" "	1 00
28.	North Part of Babine and Takla Lakes	½ inch to 1 mile	1 00
28A.	Stuart and Babine Lakes	1 inch to 1 mile	1 50
29.	Chilcotin, West 124 Meridian	" "	1 50
29A.	Anaham and Abuntlet Lakes	" "	1 50
29B.	Nazko and Chilcotin River Valleys	" "	1 50
30.	Bonaparte River Valley and Canim Lake	" "	1 00
31.	Bulkley Valley	" "	1 50
31A.	Francois and Babine Lakes	" "	1 50
32A.	Tatlayoko Lake	" "	1 50
32B.	Homathko and Klinaklini River Valleys	" "	1 50

TABLE E.—DEPARTMENTAL REFERENCE MAPS—*Concluded.*

Price-list of Blue-prints—Concluded.

		Scale.	Price.
34.	Lot 4593, Kootenay District, West Portion, Flathead River	2 inches to 1 mile	1 00
34A.	Lor 4593, Kootenay District, East Portion, Flathead River	" "	1 00
35.	Saltspring, Gabriola, and Adjacent Islands	1 inch to 1 mile	1 00
38A.	Groundhog Coal Area, East of Meridian	" "	1 00
38B.	Groundhog Coal Area, West of Meridian	" "	1 00
38C.	Upper Nass River Valley	" "	1 00
39.	Euchiniko Lake and Upper Blackwater River Valley	" "	1 00
40.	Tetachuck and Euchu Lakes	" "	1 00
42.	Big Bend, Kootenay District	" "	1 00
42A.	Adams Lake and River	" "	1 00
42B.	Canoe River Valley	" "	1 00
42C.	Columbia River Valley (vicinity of Bush River)	" "	1 00
43.	Peace River, South of Dominion Government Reserve	" "	1 00
45.	Foreshore of Vancouver Island (E. & N. Railway Belt)	" "	1 00
46.	Saanich District and Islands	" "	1 00
47.	Peace River Valley, West of Dominion Government Reserve	" "	1 50
48.	Crooked and Parsnip River Valleys	" "	1 50
49.	Pine River Valley, Peace River District	" "	1 00
50.	Parsnip and Peace River Valleys	" "	1 00
51.	Finlay River Valley	" "	1 00
52.	Atlin Lake and vicinity	½ inch to 1 mile	1 00
53.	Telegraph Creek and Stikine River Valley	" "	1 00
54.	Upper Nass River Valley and Meziadin Lake	1 inch to 1 mile	1 00
18-9S.	Rossland and South End of Lower Arrow Lake	" "	1 00
17-9S.	Nelson and Salmon River Valley	" "	1 00
16-9S.	Moyie River Valley	" "	1 00
15-9S.	Elko vicinity	" "	1 00
15-9N.	Fernie and Crowsnest vicinity	" "	1 00
16-9N.	Cranbrook and Kootenay River Valley	" "	1 00
17-9N.	Kaslo and Kootenay Lake	" "	1 00
18-9N.	Edgewood and Lower Arrow Lake	" "	1 00
15-0.	Elk and White River Valleys	" "	1 00
21-23.	Duncan Lake and Columbia Lake	" "	1 50
18-20.	Nakusp and vicinity	" "	1 50
27-29.	Columbia River Valley, Wilmer and Spillimacheen	" "	1 50
30-32.	Trout and Upper Arrow Lakes	" "	1 50

NOTE.—These reference maps show lands alienated and applied for, "Timber Limits," "Coal Licences," etc., surveyed and unsurveyed. They are compiled from all available data and are constantly being amended, and their accuracy is therefore not guaranteed. They were prepared originally for departmental use, and, having proved of value to the public, blue-prints of same are now on sale.

Victoria, January 1st, 1919.

VICINITY OF SWAN LAKE, PEACE RIVER DISTRICT.

By A. J. Campbell.

December 30th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—In accordance with your instructions, I proceeded to the Peace River District by way of Edmonton and Grande Prairie. The longitude of a point near Pouce Coupe, in the Peace River Block, had been determined in 1917 by telegraphic observations. From this point R. W. Cautley, D.L.S., of the Interprovincial Boundary Commission, located the position of the 120th meridian. He produced this meridian south, past Townships 25 and 26, of the British Columbia surveys in that district. This position of the 120th meridian, which is the east boundary of British Columbia, lay between 18 and 19 chains east of the east boundaries of Townships 25 and 26. These had formerly been known as the British Columbia boundary. Thus this strip of land was added to the Province. My instructions were to survey this strip into lots and also to complete the survey of Townships 26 and 27.

We left Grande Prairie with an incomplete party in the hopes of being able to obtain men from among the settlers around Swan Lake. Men were secured and the work was proceeding with the greatest possible dispatch, when a member of the party was taken ill with the Spanish influenza. This dread disease spread through the party until, finally, every member except one was either down with it or convalescing from it. I was thus compelled to cease operations with the work allotted to me in an incomplete state.

The country in the vicinity of Swan Lake is rolling, with long even slopes. From Swan Lake, which lies in the northerly part of Township 26, a long gentle slope rises to the south boundary of the township. This elevation holds, generally, through Township 27 in a gently rolling series of low hills, practically all of which could be put under cultivation. A few small creeks of good water were found, and these probably contain running water throughout the year. Several dry creek-beds were crossed.

The district is served by a good wagon and motor road from Grande Prairie, which is the present terminus of the Edmonton, Dunvegan & British Columbia Railroad. This road enters into British Columbia from Alberta in the southerly part of Township 26, passing to the south of Swan Lake, at a distance of approximately seventy-two miles from Grande Prairie, and follows on to Pouce Coupe, in the Peace River Block, which is about eighteen miles from Swan Lake. The main line of travel serving Pouce Coupe and Swan Lake Districts is along this road. Railroad surveys have been made from Grande Prairie, and it is possible that the district will have the advantages of the railroad before many years. From Spirit River to Pouce Coupe the Edmonton, Dunvegan & British Columbia Railroad has a line partially constructed. The great hope of the settlers in the vicinity is that the railroad surveyed from Fort George to Pouce Coupe will be constructed in the near future. This will bring the district into very much closer relation with the Province to which it belongs.

There is a weekly mail service from Grande Prairie to Pouce Coupe, which is the nearest post-office. It is possible that a post-office will be established in the vicinity of Swan Lake at an early date. The settlers generally have an arrangement with the driver of the stage to leave their mail at their residences or at some convenient point along the route. A Government telegraph-line follows along the road from Grande Prairie to Pouce Coupe, which is the nearest telegraph-office. At present the closest connection to the outside markets for the disposal of grain, cattle, etc., is by way of Grande Prairie, but it is very possible that before long settlers will be able to dispose of their produce without the disadvantage of such a long haul.

The soil generally is a rich loam over clay or sandy clay subsoil. In places that have been visited by several forest fires the surface soil has been burnt to the clay or sand, but in time such places will return to their original condition, due to the extremely heavy growth of rich grasses and peavine. The district is primarily a cattle country. Good grasses, peavine, and vetch grow luxuriantly. The cattle run out through the winter, but of necessity require to be fed through the midwinter months. Two tons of hay per head of stock is considered sufficient. Garden produce, such as potatoes, turnips, parsnips, cabbage, etc., of an exceedingly good quality can be grown. While up to the present not much has been done with grains in the immediate vicinity, there is no doubt that wheat and oats can be raised with great success. The Pouce

Coupe District, which is subject to practically the same climatic conditions, is becoming famed for its yields of grain.

The greater part of the district under discussion is covered by small poplar and willow-brush more or less dense. Considerable open stretches are found in the neighbourhood of the road and Swan Lake. Some spruce and tamarack of good size grows on the north of the lake. To the south through Township 27 the growth becomes more dense, thick willow, and in places alder-brush is seen. In the southerly part of this township there is larger timber in clumps and in stretches along ridges and low-lying lands. Jack-pine, spruce, and poplar to a diameter of 18 inches, with an average of 6 to 8 inches, is found in these places. There is exceedingly thick windfall in this part. The country has all suffered from forest fires and in places has been burnt over several times. In these the old growth has completely vanished and a new growth of small poplar and willow has sprung up.

As we went into the country in the fall of the year, I am not in a position to speak from a personal observation concerning the rainfall and other climatic conditions. From reports received the summers are bright and warm, with sufficient rain. The ice leaves Swan Lake early in May and generally commences to freeze over about the middle of October. This year ice commenced to form around the shore of the lake on October 20th, and the lake was completely frozen over early in November. Summer frosts are likely to occur, but generally early in the season. This year there was a heavy frost over the greater part of the Peace River District early in July, but the grain apparently was not greatly injured, as good yields were harvested in most parts. In this connection the experience of one settler in the vicinity of Grande Prairie can be mentioned. He had 100 acres of wheat and after the frost decided to cut it for green feed. For some reason 5 acres were left and these later gave a yield of 30 bushels to the acre.

Moose, deer, and bear are numerous. Few were seen by members of the party, but numerous tracks were found in the new snow, particularly those of moose. Grouse and some prairie-chicken were noted, but reports say it was an exceedingly poor year for these. Rabbits are very scarce, but from indications have been very numerous and will probably be so again. Swan Lake is famed for the quantities of ducks and geese that rest there and thousands of them were seen. Whitefish and pike are plentiful in the waters of the lake.

I have, etc.,

ALAN J. CAMPBELL, B.C.L.S.

ROSE LAKE, COAST DISTRICT, RANGE 5.

BY H. C. BLACK.

December 14th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have completed the surveys mentioned in your instructions of October 30th in the vicinity of Rose Lake. The country in this district south of Rose Lake and west of Palling is timbered mainly with poplar and jack-pine, with some spruce. The timber is open and suitable for grazing, the undergrowth containing a good percentage of peavine. As the railroad has been fenced in this danger to stock has been removed. There are also some pieces of willow bottom scattered about which when cleared up should make good hay land.

There are some ten settlers here, some of whom have brought in a little stock, and others are expected in in the spring. They have already cut out two roads, one to Rose Lake and the other to Palling, but these need improving. They are in communication with the Dominion Government and hope soon to have a post-office established at Rose Lake. The present post-office and Government telegraph-station are at South Bulkley. A small store has also been started at Rose Lake, where the necessaries of life may be obtained.

I have, etc.,

H. C. BLACK, B.C.L.S.

MOOSE SPRINGS, CARIBOO DISTRICT.

By F. P. Burden.

October 10th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit a general report on the country surveyed by me during the present season. The portion surveyed lies about twenty-five miles from the City of Prince George in a southerly direction, and is traversed by the Fort George-Blackwater Road. The immediate vicinity in which most of my work was done is known as Moose Springs, a name derived from a large spring of excellent quality situated beside the road in the pre-emption of O. B. Hughes.

Generally speaking, this is a rolling country, having low-lying hills or ridges, usually running from north to south, with level benches or level depressions between. As before stated, the Fort George-Blackwater Road runs through this region and provides the only means of access thereto. For a road in a new country it is in reasonable shape and is being improved from year to year. Cars can now run over it, though it can hardly be called a motor-road. Branching off from this, about two miles south of Twenty-one Mile, is a settlers' road, built by pre-emptors to enable them to reach their locations. It extends south-easterly for about eight miles, but is barely passable in spots and is built with but little attention to grades. The nearest post-office and market is at Prince George, reached by the wagon-road above referred to.

During the summer considerable prospecting has been done in this vicinity, and a number of claims having good copper-showings have been located. No development-work has yet been done, but interest is being aroused in this part of the district, and it is only a question of time until systematic prospecting and development will prove or disprove the presence of minerals in paying quantities.

The soil on the ridges is usually a sandy loam or gravel. On the level benches or valleys it is a black loam or chocolate-coloured loam.

Very little farming has been done, but excellent results have been obtained in gardens, all manner of vegetables being produced, and of fine quality. Remarkably fine sugar-beets were growing in Duncan MacKenzie's garden, while the potatoes in O. B. Hughes's garden were unsurpassed by any I have seen this season. Small fruits also flourish, but fruit-trees have not yet been tried, although a few miles east, on the shores of West Lake, I believe apples have been grown.

This area, with the exception of a few wet meadow-like spots, is thickly wooded, with jack-pine and poplar predominating. In some places the jack-pine is large enough for tie-timber. Under the ordinary methods of first-hand clearing the cost would run from $40 up to $75, but doing this on a large scale with the proper equipment, this could be reduced 50 per cent.

During spring and summer there is sufficient rainfall to ensure a good growth, and there is a heavy snowfall in winter, lasting usually until May, and beginning to fall in November. Summer frosts are still a detriment, but I have no doubt the clearing and cultivation of fair-sized areas will do away with these to a great extent.

Game is fairly plentiful, moose and deer being the most important. Fair-sized catches of fur are still made every winter. This includes beaver, lynx, fisher, marten, and mink.

Altogether, this area compares very favourably with other portions of this district now being settled.

I have, etc.,
F. P. Burden, B.C.L.S.

VALLEYS OF BAKER, NARKOSLI, AND MAKIM CREEKS, CARIBOO DISTRICT.

By R. W. Haggen.

December 20th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I beg to submit the following report on the surveys made by me during the past season:—

The territory covered was the Fraser River Valley between Soda Creek and Kersley and the valleys of Makim, Narkosli, and Baker Creeks, in addition to which two pre-emptions were surveyed at Goose Lake, on the Quesnel-Fort George Road. All the outlying lots in this section were tied in, with one exception, and twenty-six pre-emptions surveyed; while data was gathered as to topography throughout the section, so that the new issue of the Quesnel Sheet of the pre-emptors' maps may be the more complete.

The first work undertaken was the survey of pre-emptions in the valley of Baker Creek, between fifteen and thirty-two miles west of Quesnel. Three of these were taken up with the intention of farming rich bottom lands, while the others cover swampy areas which may, after drainage, be converted into hay meadows. On four of the places hay was cut this year, but I was disappointed in the quantity per acre; it is all sedge, but will doubtless fulfil the purpose of keeping stock alive during the winter. However, I should judge that it is necessary to cut at least 2 acres of hay per head of stock. The meadows as a rule do not lie along creeks, but around small lakes. When drained, it has been the experience in other parts of the country that such meadows cannot be depended upon. In wet seasons they will produce a good crop, while a dry spring, or light snowfall in winter, will result in a very slim crop. The past season was not favourable, and this doubtless accounts for the light crop. However, I think there is feed and range available for 300 head of cattle in the district near Puntchesakut and Puntataenkut Lakes.

There is considerable good range available for several miles up the valley of the Middle and South Forks of Baker Creek, in pot-holes and in poplar, where peavine grows well. On some of the fire-killed areas there is a good growth of summer feed; others are barren.

On the bottom lands the cost of clearing would probably be $40 to $60 per acre. On these timothy grows well, and probably clover would yield a good crop. On account of the altitude and frequency of summer frost only hardy vegetables can be grown. Potatoes are grown for the use of the settlers, but they are, naturally, not of a marketable quality. Root-crops, cabbage, and cauliflower, however, grow well.

Most of the settlers have been on their places for several years and seem well pleased with their progress, though none could make a living off their pre-emptions alone until considerably more improvement has been made; in fact, most of the places contain so small an area of land that could be made productive that they never would support a family. However, each settler has some stock that is increasing and produces some revenue; he has a comfortable home, can live economically, and by means of trapping in the winter and working out in spare times he is enabled to make a comfortable living, and is probably better off than many a man in the cities. They at least have their living, and their stock would represent savings, apart from the value of the improvement of their holdings, which has a certain selling value. No doubt in a year or two there will be a school in the settlement. There is no post-office yet, but the places lie along the mail route from Quesnel to Nasko, where there is a monthly mail service.

The settlers tell me that they rarely feed their stock before Christmas, and turn out in April. In the winter there is rarely 2 feet of snow. I presume that the low temperature in winter would probably be about 60 degrees below zero.

During the trapping season the settlers arrange among themselves for the feeding of their small bands of stock together. Each season the fur-catch contains a fair number of fox, chiefly cross, but some silver and black, which have a good selling value. The other fur is beaver, weasel, musk-rat, and an occasional fisher or lynx.

The locality seems to be poor for game. There are few deer and grouse. In the fall there are quantities of ducks and geese. I also saw a rather rare sight in the district, a flock of pelicans. In the marshes around the lakes there are some of the despised "sand-hill cranes," which are really excellent to eat, though not easy to shoot. In Baker Creek and Puntataenkut Lake there are trout of various sizes.

About twenty-five miles to the west of this settlement, in the lower end of the Nasko Valley, there are some good herds of cattle.

Vicinity of Goose Lake.

On completion of the work in this locality I moved to Goose Lake, on the Fort George Road, and twenty-five miles from Quesnel. Here two pre-emptions were surveyed, one containing a portion of the meadow around Goose Lake and the other containing some meadow land along West Creek, the holder being absent on military duties. The first of these pre-emptions contains only a few acres of very poor meadow, and the balance of the land is of poor quality, but would afford some pasture. The place on West Creek contains the best land in this locality, but is not large. By clearing willows 40 acres of hay land might be utilized. Lying along a creek, this meadow has not the drawback of meadows around the lakes. By damming the creek the ground can be flooded each year, then drained off so that it is dry in haying-time; thus a more reliable crop is secured. If worked to its capacity this place would probably carry thirty-five or forty head of stock. The climate, however, is rather more severe than that of the Baker Creek Valley, and undoubtedly there are severe summer frosts. Outside the hay meadow there is no agricultural land, the sides of the valley being rough and stony, with a dense growth of jack-pine.

There are plenty of beaver along this creek, and the fur-bearing animals are doubtless to be found in the vicinity. It is ten miles north of the Baker Creek Valley, but there is a high ridge between. There are ducks and geese on the lakes in the fall.

During the days of heavy travel on the Fort George and Fraser Lake Roads Goose Lake was a regular stopping-house, and it was at this time that settlers went to this locality, and also farther to the north along the road in the vicinity of Swan Lake. All these places are, however, deserted. There is usually an operator at the Blackwater Telegraph-office, on the Yukon Line, and one at Bobtail Lake, forty miles westerly; apart from these, the country is absolutely deserted after one passes Bouchie Lake, six miles from Quesnel. In the winter the Inland Express Company keeps a man at Goose Lake to look after horses. It is rather a change from the days, a few years ago, when I have been one of twenty paying 50 cents for the privilege of sleeping on the dirt floor in the old Goose Lake Cabin, and glad to get shelter; and memory also reverts to a night in a cabin at Blackwater when it was 35 degrees below. That cabin was not chinked, a folding stove was intended to provide warmth against a wind that blew the snow clear through the cabin, while we tried, unsuccessfully, to thaw bread broken into fragments with an axe. Now the cabins are comfortable but deserted; then they were incomplete and crowded.

In these days, with numbers of horses on the road, any kind of hay was valuable on account of the demand, which accounts for the meadows being taken up. Most of the places have been Crown-granted and abandoned, but as other portions of the district are settled up some settlers will probably again be found along the road with small bunches of stock.

Near Mouth of Narkosli Creek.

The next work done was on the west side of the Fraser River, between Higdon and Narkosli Creeks. Two of the parcels, the owners of which are overseas, are, I think, about the poorest pre-emptions I have ever seen, and I am at a loss to understand why they were ever recorded. One consists of a rocky hillside along the Quesnel-Alexandria Road, and the other of a swamp, that shows no sign of producing hay, on the summit of the plateau. Of the other parcels, one contains a little flat near the mouth of Narkosli Creek sufficient for a settler with other means of support to raise a garden and sufficient feed for his stable. He has raised excellent vegetables during the past season. The other parcels were on a bench above the road, ten miles from Quesnel; they contain some good land, which is now covered with a growth of birch and cottonwood, which could be cleared at a cost of $25 to $40 per acre. A good spring provides domestic water. As a general rule this bench would, I think, be immune from summer frost, and good crops of roots and grain should grow without irrigation. From the nature of the vegetation I should judge that clover would also grow well. A rough road from the Quesnel-Alexandria Road runs through this land.

This locality has good access to Quesnel. The main road to Narkosli Creek is suitable for motoring, and the creek is only fourteen miles from Quesnel. A steamer on the Fraser River

provides freight and passenger service during the summer months. Quesnel is the post-office for the locality. There is no school. The benches along the Fraser suffer from an occasional summer frost, but generally crops do well. Irrigation is necessary for hay-crop, but not for grain. Generally speaking, the soil is a sandy loam, but there are patches of sand and gravel. There are some clumps of fir timber, but the vegetation generally consists of jack-pine and aspen.

The benches along the river here vary in width up to one mile; then a steep hillside rises to the plateau above. This plateau in general consists of rolling land, wooded with jack-pine, and somewhat stony; the soil is hard-pan to near the surface. There are scattered hay meadows small in extent; through the jack-pine the grass is generally of a poor feeding quality, but in open patches there is good range.

Messrs. Baker, Higdon, Wright, and Roddie are running cattle in this locality, probably 220 head altogether, and there would be summer feed for a larger number. Mixed farming is the industry to which the lands along the Fraser River are best adapted.

Alexandria, East Side of Fraser River.

Three pre-emptions were next surveyed in the vicinity of the Cariboo Road, in the Alexandria District, between twenty and thirty-five miles south of Quesnel. Two of these were owned by soldiers. The first lot lies in a draw about a mile from S. Hilborn's ranch, at the 201-Mile post, Cariboo Road. In this draw there is some very nice land, where the soil is a deep loam, the arable land being some 30 acres in extent. The vegetation consists of a rather dense growth of cottonwood and willow, and would cost at least $50 per acre to clear. There would also be considerable probability of summer frost. Root-crops and oats should grow, however.

Lot 9527, the next lot surveyed, is, I should say, useless as a pre-emption, though the settler probably thinks otherwise. It is hilly, dry, and wooded with fir which is not of good quality. There might be 500,000 feet of merchantable timber available on the whole area. There is fairly good range on the side-hills. The land lies to the south of Cuisson Creek and about a mile and a half up the hillside from the 190-Mile post, Cariboo Road.

The other pre-emption surveyed in this locality contains a fraction along the Fraser River, immediately south of the Alexandria Indian Reserve. There is some good land in the flats, but it is dry, and without irrigation the crops raised are very poor. A portion is open and grassy; the balance is wooded with cottonwood, willow, and brush. Near the river a considerable portion has been hydraulicked, and is in consequence of no agricultural value. This lot is near the 185-Mile post, Cariboo Road.

From Cuisson Creek, at the 190-Mile post, to this place there is a wide bench along the river, and it has been settled for years. Portion of the bench is owned by the Indians, and some under old pre-emptions, the owners of which are dead. Without irrigation the crops raised are very poor, and with such an excellent water-supply as Cuisson Creek available one cannot understand why irrigation systems were not constructed years ago. It is probable that sufficient water is available for the whole bench, as there are excellent storage-basins in the creek-valley, and the creek always has a good volume. Thirty years ago Chinese miners built ditches and dams and utilized the water. The ditches extend the full length of the bench. It is probable that lack of ambition and co-operation account for the state of affairs that has been allowed to exist. One man told me he "always had a good half-crop." In the seasons I have seen these crops I should say that through lack of proper farming methods the land has become so run out that it does not raise one-fifth of what it should. One field has been in oats each year for a quarter of a century, and the crop this year did not yield more than 100 lb. of oats per acre, and these were mostly wild oats. Windt Bros., who recently purchased the old Cuisson Ranch at the mouth of the creek, are installing an irrigation system. The line of the Pacific Great Eastern Railway passes along this bench, and probably, when that line is complete, new owners will have the other ranches, and one may hope, in the future, that the "Alexandria Flats" will do their duty as they should.

Upper Narkosli Valley.

I next surveyed two pre-emptions in the Narkosli Valley, about eight miles west by road from the Alexandria Ferry, on the Fraser River. This creek runs through a fairly open, grassy valley, and along the creek there are some good flats on which timothy will grow well. In many places there is a dense growth of willow. There are a number of unsurveyed Indian allotments along the valley, and four white settlers have also located.

The valley is here at an altitude of some 2,500 feet. There is considerable summer frost, and the hay-crop is, I think, the only crop that would be reliable. The soil is a sandy loam, and the flats along the creek are free of rocks. There is some range along the valley, where the cattle from the ranches near Alexandria feed. The Narkosli is a large creek, with three branches which rise some twenty miles from Alexis Creek. I have measured the stream in October, when it is probably at its lowest, and it then had a flow of 60 cubic feet per second. A portion of the water is now diverted to irrigate the Sunnyside Ranch at Alexandria. I hope to see the day when it will also be used to irrigate the benches between its mouth and Higdon Creek, and when the present system to Sunnyside Ranch will be enlarged to include a goodly portion of the benches on the west side of the Fraser Valley at Alexandria.

On the South and Middle Forks (Twan and Webster Creeks) there are some excellent hay meadows, from 10 to 80 acres in extent, on which a good crop of "sugar-cane" hay it cut, two hundred and fifty head of cattle are now wintered on these meadows, in addition to horses.

I tied these lots to Lot 9494, Tingley Creek, which had previously been tied to surveys in the Fraser Valley. On this tie there are a couple of swamps that may possess possibilities as hay meadows. I am also informed that there are other meadows to be found in the district. This tie did not pass through any agricultural land.

The next tie was from the most southerly lot on Twan Creek to Lot 433, an old Crown-granted hay meadow which was not made use of for several years. Much discussion had arisen as to the creek on which this meadow lay, whether on Twan or a fork of Makim Creek. It is actually on a branch of Tingley Creek. Several people have staked it during the past few years, and various descriptions of its location were given. In these cases, with Gazette notices before me, I am reluctantly bound to conclude that the stakers were badly lost in the woods.

A road to this meadow leads by way of McRae's meadows to Riske Creek, some thirty-six miles distant. An old trail also leads to Twan's meadows, five miles, and another, which is almost undiscernible now, to Lot 102, Yorston's meadows, on Makim Creek.

This meadow, on Lot 433, is now owned by P. D. McRae, a stockman of Riske Creek. I have seen few meadows which equal it in yield per acre. While the meadow is scarcely more than 80 acres in extent, the crop is nearly 120 tons. It has a good bottom and is easy to flood and drain.

At this time I was compelled to suspend the field-work for a month and pass the time in the unpleasant precincts of an isolation hospital; the "flu" germ was very active in Cariboo.

Mouth of Hawks Creek.

Upon resuming work I surveyed a pre-emption at the mouth of Hawks Creek, three miles below Soda Creek, and, incidentally, made a tie between lots along the Fraser River. The pre-emption contains about 25 acres of bench, which would be productive if irrigated. In its present condition grain and vegetables can be raised. The timber is fir, small in size, and there is some open bench. The cost of clearing the timber would be $40 to $50 per acre. There is a good road to Soda Creek. Along the river, on either side of this lot, the land is very rough and wooded with scrubby fir.

Meldrum Creek, near Callanan Lake.

Some outlying lots on Shell and Meldrum Creeks were next tied to the surveys at Callanan Lake, which had been tied previously to the Chilcotin township surveys. On Shell Creek there is no land that is of any value, with the exception of small meadows which were taken up a number of years ago.

The valley of Upper Meldrum Creek is generally rolling and wooded with jack-pine and poplar. There are numerous lakes, the largest being Callanan, Meldrum, Natsy, and Dester. The only land that is at all suitable for farming is on the shores of Callanan Lake, and that is not of very good quality.

The meadows along Meldrum Creek are also disappointing, the hay being of a very poor quality. However, it brings the stock through the winter.

The road from Riske Creek, thirteen miles from Callanan Lake, to Makim Creek follows the valley for some distance, and trails lead to Meldrum Creek Settlement, on the Soda Creek-Chilcotin Road.

MAKIM CREEK.

The last work of the season consisted in tying in some lots to Lots 102 and 109, Makim Creek. Between Lots 109 and 9181 the country is swampy and of no value. Between Lots 102 and 242 there is a small meadow which has been staked as a lease; the balance is mostly rolling, stony, jack-pine country, with a few grassy pot-holes. Lot 242 appears to be a miserable meadow, and, so far as I know, it has never been utilized.

Along Makim Creek there are some excellent meadows, held by Messrs. Yorston, Cotton, Arthur Bros., and Moon. About 1,800 head of cattle from the Chilcotin District are wintered on the meadows of Makim and Meldrum Creeks; the Makim Creek hay is of good quality.

MAKIM CREEK TO ALEXANDRIA.

Lots 102 and 103, Makim Creek, were originally taken up by William Adams in connection with Sunnyside Ranch, Alexandria, and a road was built between the places. Until a few years ago this road was considerably travelled. This season, when returning to Quesnel, I came out over it, but it is badly covered with windfalls and will hardly be of use as even a trail now. In one place we spent three hours making one mile of headway, and only travelled twenty miles in ten hours.

The old Hudson Bay Trail from Narkosli Creek to Alexis Creek is also badly covered with fallen timber, and it is practically impossible to follow it now. As this trail provides an excellent short route from the Upper Chilcotin to Alexandria and the Fraser Valley, it is a pity that it is not kept open.

INDUSTRIES.

The chief industries of the Cariboo District at the present time are farming, stock-raising, and mining. The farming is chiefly confined to the Fraser River Valley. Excellent root-crops are grown and various grains. Wheat is milled at Soda Creek and local flour used throughout the greater part of the district. The vegetables will compare favourably with those raised in any part of the Province. Several of the farmers have good dairy cattle, and a fair proportion of the butter used is made in the district. Most settlers have a few hogs and there are small flocks of sheep.

The stock-raising industry is the mainstay of the Chilcotin, Alkali, Lac la Hache, and 150-Mile House localities. Individual ranchers have herds varying in number up to as high as 1,700 head. In the fall the cattle are driven to the Pacific Great Eastern and Canadian Pacific Railways, at 59-Mile and Ashcroft respectively. This is a flourishing industry at the present time owing to the high price of beef.

Mining is at present confined to placer-grounds in the Barkerville and Horsefly, while one claim is operated at Cottonwood Canyon, on the Fraser River, twenty miles above Quesnel. However, the output this year is disappointing. Low values of platinum have also been found. Whether there is "pay" in the district will be found out in the future. Scheelite containing tungstic acid occurs at Hardscrabble, near Stanley. In the range to the east of the Fraser River there are several outcrops of copper which may be of value when the railway is completed. At Birrell Creek, Quesnel River, gold and platinum are being obtained. There is a large coal-body at Australian Creek. In addition to the foregoing, there are good deposits of diatomaceous earth, carbonate of lime, and clay, which may form the basis of some future industry. Kaolin is reputed to have been found near Sheep Creek, but I have not seen the samples.

TRANSPORTATION.

The main artery of transportation in the district is still the old Cariboo Road, and it will continue so to be till the Pacific Great Eastern Railway is completed. From this road branches run to various parts of the district. On the Fraser River there is a steamer service between Soda Creek and Fort George, and freight is carried at very reasonable rates. There is, however, one bad drawback to a river-steamer service in the northern waters, so far as the farmer is concerned. About the middle of September, before his crop is ready to market, the water is so low that the service becomes erratic, and by the first of November the steamer is unable to operate at all; the steamboat service is from May 1st to October 31st. This involves the holding-over of practically all freight for the outside until the following summer. However, there does not usually seem to be much more produce raised in the district than the local market demands; though, with transportation and an outside market assured, there is no reason why much more produce could not be raised. This year there is reported to be a surplus of wheat.

Settlement.

Owing to conditions incident to war, cessation of railway-work, and enlistments, a number of settlers have left the district. In one locality there were over sixty settlers in 1914; to-day there are not over ten. Many of these obtained Crown grants before leaving for other fields. No doubt some will now return to these places, but many are permanently abandoned so far as the original locators are concerned. This condition occurs largely throughout the district. At present there is little demand for the land, and the settlements will doubtless fill up again when development is renewed in the district. Some localities are good settlement areas.

Game.

As the district is large, it contains many varieties of game and fur-bearing animals in the different localities. The big-game hunter can find much enjoyment in the Barkerville region, where the moose considers himself monarch; at least, one sees him frequently along the margins of the lakes and rivers, and he is the picture of open defiance, ready to fight when molested. The grizzly bear is also at home in this region, and some splendid specimens have been obtained. On the hills caribou are numerous, and to the north-east one enters the mountainous country where the goat has elected to live. Of fur-bearing animals, marten, beaver, and lynx are the principal. In the Quesnel Valley and along the Fraser and west of the Fraser there are some deer. Fair catches of fur are made all over the district. On the large creeks and in Quesnel River there is excellent fishing.

I have, etc.,
R. W. Haggen, B.C.L.S.

HORSEFLY RIVER AND QUESNEL LAKE, CARIBOO DISTRICT.

By F. Butterfield.

October 23rd, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit the following report on territories covered during the past summer:—

These territories contiguous to Horsefly and Quesnel Rivers comprise one of the oldest portions of our Province. History affirms that Peter Dunlevy, whilst at the mouth of Chilcotin River searching for gold, was directed by an Indian to meet him at a certain time and place. The appointment was kept and Dunlevy was introduced to what ultimately became the famous Horsefly mines. This was in 1858. For years afterwards there was a rapid influx of people to the Cariboo; indeed, the 1859 rush was directly responsible for the foundation of New Westminster. From Horsefly the miners extended energetic operations northerly, and Quesnel River (remarkable rather for inactivity at present) in 1860 gave employment to "600 miners, who earned from $10 to $25 per man per day." Since the decay of mining there has developed apparently an agricultural effort, sometimes more and very often less successful. The amount of success depends upon the varying conditions the individual farmer is called upon to contend with, and I believe, to a greater extent than in most places, upon his wisdom and foresight.

Every year he has to prepare for a five-month winter siege, during which time he must feed his stock; and every summer he hopes, against all expectations, the frost will spare his crops. The inevitable summer frost is a source of torment to the agriculturist. Unfortunately, owing to the high altitude of the district in general, it is problematical if the farmer can ever be immune from its scourges, as is the case in some of the "muskeg" districts, where clearing and drainage have been so beneficial. Here, as in all ranching localities at the present time, much difficulty was experienced during the past summer in obtaining hired help for haying. At the time of my leaving this had developed a serious aspect owing to exceptionally heavy precipitations and the necessity, in consequence, of handling hay rapidly. I understand, however, that September proved as exceptionally fine as August had been wet, so it is not expected there has been an undue depreciation in the hay-crop.

On account of so much moving over long distances at a time it was impracticable to keep records of temperatures and rainfall, and likewise, unfortunately, only a very rough idea could be gleaned of the adaptabilities of soil and climate to crops. However, notes were made of all noticeable points of this nature likely to be of worth and interest. These are embodied in this report under their suitable headings.

CHARACTERISTICS.

Horsefly River flows into Quesnel Lake about sixteen miles from the lower extremity. In its course it drains probably 600 square miles of territory, flowing westerly and then northerly and discharging into Horsefly Bay. Quesnel River, or at least that portion of it with which I have to deal, drains Quesnel Lake, making its confluence with the North Fork at Quesnel Forks about seven miles and a half distant from the lake. The only tributary to these waters of any importance in this report is Moffat Creek, which flows northerly, uniting its waters with those of Horsefly River at the big bend. The creeks flowing into the included section of Quesnel Lake are insignificant; the largest is only a few links in width.

The most notable characteristics of the country are its narrow valleys and usually high hills. These are more marked on approaching Quesnel Lake and Quesnel Forks. Indeed, the old mining town of Quesnel Forks is literally hemmed in. There is much available grazing territory above Horsefly Bay, but little or no agricultural land of any description from there to Quesnel Forks.

Harpers Camp, the most populated settlement, is situated near the junction of Moffat Creek with Horsefly River. It marks to all intents and purposes the end of communication and the Horsefly Road. The other six or seven miles of the old Horsefly Road, which was built, as the name implies, for the benefit of Horsefly Mine, has seen very little travel for a number of years. The whole district is liberally supplied with roads, but, alas! most of them are in poor shape, as the travel does not now warrant their upkeep.

ACCESSIBILITY.

At the present time the most important of these after leaving the Cariboo Road is the Horsefly. I refer to the road between the 150-Mile House and Harpers Camp. The road running from the 108-Mile House to Harpers Camp bears the same name, though locally it goes under the name of the 108 Road to distinguish between the two. As I have only been over a portion of the latter I can only speak from hearsay, but I understand it is an impossible route for the greater part of the year. The 150 Road, however, is in very fair condition, excepting very wet periods, when it has a tendency to develop "chock-holes." A weekly mail stage (horses or auto, according to road condition) carries passengers between the 150-Mile House and Harpers, while occasionally one of the several automobile companies operating out of Ashcroft send in a car. Any small party will find this by far the cheapest form of transportation.

About fourteen miles of new road has recently been completed from Harpers Camp up the north side of Horsefly River to some distance above Wood Jam Ranch. This is quite good for motor traffic, but its continuation (the old road) is in miserable condition. Harpers Camp is the junction of several roads in addition to these—Beaver Valley Road, in good condition; the old Wood Jam Road, now practically out of use, rocky, steep, corduroy, and culverts decayed; and also there is the continuation of the old Horsefly Road, the usual route to Quesnel Lake. This latter is in surprisingly good condition considering the small amount of traffic which goes that way, and could be made perfectly good should circumstances ever warrant a small expenditure. From Horsefly Mine to Squaw Flats the road is of the roughest description for any kind of vehicle, but yet provides a means of transportation far superior to pack-train.

It is really a settler's road, having been built partially over one of the cordwood roads originally cut to convey wood to Horsefly Mine, and partly, I believe, cut through the timber by Mr. Hooker, a settler at the mouth of Horsefly River. A great amount of laborious grading for one individual to accomplish has been performed on the last half-mile. Here the road follows side-hills on a very fair grade down to the river-level at Squaw Flats. From Squaw Flats it is possible with some manipulation to travel by boat the remainder of the distance to Quesnel Lake, but the labour involved on returning, lining up and dragging over bars, rather mars the advantage of water over land transport. Mr. Hooker's road extends some two miles beyond Squaw Flats, but here had to be abandoned, the nature of the country involving very heavy grading. From here, however, he built a pack-trail terminating on the bank of Horsefly River about half a mile

from the bay of the same name. This latter portion of the river is quite smooth and presents no difficulties. Although wagons and pack-horses are readily obtainable at Harpers Camp, it is a distinct advantage to procure the services of some one who has a working knowledge of road and trail. There are some three or more boats on Quesnel Lake fitted with engines of varying types, as also several craft without motors, but communication with the owners is commonly a lengthy process. From Quesnel Dam (at the foot of Quesnel Lake) one road runs to Little Lake, while a second connects via Quesnel Forks with 150-Mile House. As this road is largely cut in the rock, much of it will stand the wear of ages. One rock-slide, which could be remedied in a few hours' work with the shovel, is the only obstruction between the dam and the forks. A network of highways are open from Quesnel Forks to the many points in the mining district. Inquiries made of an authority elicited the information that the Polley Lake Trail was impassable even for a saddle-horse.

	Miles.
Distance from 150-Mile House to Harpers Camp	38
Distance from 150-Mile House to Quesnel Lake	55
Distance from 150-Mile House to Wood Jam Ranch	50
Distance from 150-Mile House to Quesnel Dam (via Horsefly)	71
Distance from Quesnel Forks to Quesnel Dam	7½
Distance from Quesnel Forks to 150-Mile House	68

While accessibility at the present time is no great problem, the matter of handling freight would be a serious one were there a sudden need for large quantities. The Pacific Great Eastern, which is located within easy distance of the Horsefly, will be a great benefit in the future.

Timber.

There is no lumber industry in any part of the district, to my knowledge; none is imported, as, when needed, boards can be whipsawn from convenient local timber. Although no merchantable timber came under personal observation, I am informed there are several good tracts that could be profitably cut were export facilities improved. Tracts of timber are reported to exist on Quesnel Lake. The lower end of the lake, however, suffered from fires some years past, leaving little but the stubs of what has at one time been a good stand of fir. Ninety per cent. of the remaining cedar, it might be said, is hollow.

Mining.

A more comprehensive knowledge than I possess is necessary to do this subject justice. There are still men in the district of clear memory who can look back to the days of '63 and converse on minutest details. Most of these, in company with other younger men, are of opinion Cariboo has yet much gold in store. At the present time mining is very quiet. Assessment-work, which usually means minimum work, is carried on as a matter of course. A company operating at Harpers Camp, which only recently put its plant in working-order, is using an ingenious dredge calculated to handle most dirt in least time. Up to present date its energies have been expended on old tailings, but results, as yet, have not been disclosed. It is rumoured that the Bullion, a well-known mine on Quesnel River, will be working again when conditions are favourable. Gold appears to be the only mineral which receives any consideration, although it is well known the mountains contain much of the baser metals. Prospectors are scattered here and there searching the creeks and old beds for new finds, while a limited number of older men content themselves with washing on their old claims. It would be pure presumption, however, to say they earn a living thereby. Horsefly gold is of the flour variety, while that of Quesnel River is said to be of a coarser nature. Shortage of water is somewhat of a handicap to the gold-miner. Many of the creeks emanating from small lakes have to furnish miners with this essential. Only too often these fail and operations cease in consequence. While the small watercourses are so uncertain, the large waterways are of a precipitous character and could be utilized as extensive power sources.

Farming and Agriculture.

A dearth of vegetables in the Horsefly District, a condition which I am told prevails annually, this summer unmistakably pointed out the enormity of the summer-frost detriment. During June and July the only means of acquiring potatoes was that of having them brought in from 150-Mile House. On July 24th, when all truck-crops were promising very favourably,

the district was visited with 10 degrees of frost. Needless to say, this had temporarily a disastrous effect, more especially on potatoes. However, in the latter end of August, although their crops had been considerably retarded, farmers congratulated themselves on an improvement over recent years. Truth to tell, most agriculturists look upon the successful growth of truck-crops as the impossible, and therefore take no means to circumvent the ravages of frost. Usually they plant a small patch and leave its future for Providence to decide. I did see smudges in use on two occasions, but Jack Frost had already done his worst. As there is some local market for potatoes, etc., it would probably be worth some enterprising farmer's while to install an overhead irrigation system of sufficient height to permit ordinary agricultural operations. This might be used as a frost-preventive by employing a fine spray set in operation nightly, and would provide a readily available supply of water in case of an exceptionally dry season. I noted at various places much "common scab" amongst potatoes, in most cases traceable to seed, continuous cropping, or wood-ashes of bush fires. Old potatoes were hard to acquire and worth 5 cents per pound in July, and earliest new potatoes came in at the end of the month.

Crops are all late, due to late springs and insufficient heat in the soil for seed-germinating. This tardiness is unduly enhanced in some localities by wet soils with insufficient drainage. Drainage requirements are very marked in all lowlands, and the soils are usually sour in consequence. There appears to be a prevailing desire to create swamps rather than drain them, in order to have swamp-hay for cattle-feed; not that timothy will not grow—as a matter of fact, precisely the contrary is true. With a little care at the beginning one or two farmers have obtained luxuriant stands. Nevertheless, timothy is very scarce in a country well adapted for hay. If the past season was at all typical of a Horsefly summer, there should be no need for irrigation. The months of June and August were much too moist to suit survey-party tastes, while July, although drier, had quite an ample precipitation. Still some of the residents possessed of garden-patches complained of "drying out." Possibly this was true where the soil was of a coarse texture and friable nature, but the hillsides with their deep green appearance bore no supporting evidence. As stock-raising gives little trouble and good grazing can be found almost anywhere along the Horsefly or on neighbouring hills, it is the most remunerative and satisfactory form of agriculture practised. The stockman needs large enough holdings to guarantee sufficient range, an ample supply of water, and somewhat extensive hay meadows.

Having these assets, together with reasonable luck, he ought to be successful. The hay meadows are absolutely essential. As already stated, calculations have to be made for provision for five months' winter feeding. Vetches and some form of clover resembling alsike grow luxuriantly, the latter especially needing only the encouragement of a little clearing. Beef is seldom consumed locally, mutton and bear-meat being the common viands of the district. Beef was recently sold at 11 cents on the hoof, but I think 10 cents is the more general price paid. Beef, hides, and furs, I believe, are the only commercial articles exported to the outer world. Demand for these as well as local consumption products exceeds the supply. Altogether there must be several hundred sheep in the district, and it is very gratifying to note, while coyotes are plentiful, they do not interfere with their successful increase. As small tracts of land will not furnish a living, the entertainment of communistic-settlement ideas is out of question here. Some complaints are heard of "winter killing." As this is a direct consequence of excessive moisture, adequate drainage ought to be provided wherever it applies.

Soils.

In a district whose soils are of different origins, or at least whose soils have undergone many different changes, it would be impossible to classify them without exhaustive study. No attempt has therefore been made, but some little notice was taken of soils in vicinities where surveys were in progress. Generally speaking, there appears to be some shortage of bases as is indicated in the higher lands; where, though, there may be little organic matter or moisture, soil shows slight acidity. This may account to some extent for the beautiful wild fruit gathered each year by residents of Harpers Camp.

Fish and Game.

The district of Horsefly and Quesnel Lake can only be described as a paradise for hunter and trapper. The large numbers of fur shipped annually, the beautiful heads of moose, caribou, and deer to be seen in settlers' cabins, and the tales that are told, all testify to this. Several

families rely absolutely on trapping to earn their daily bread, while many are to a greater or less extent dependent on the same source of livelihood. Amongst animals trapped are bear, beaver, coyote, fisher, lynx, marten, mink, musk-rat, otter, and weasel. Big game, comprising black and grizzly bear, moose, caribou, and deer, is most plentiful in the region of Quesnel Lake. Coyotes are responsible for the destruction of many deer, if the observations of residents are a base for calculations. Five deer were seen at one time last winter, driven down by coyotes and slaughtered on the ice of Quesnel Lake. Game birds are decidedly scarce, and rabbits, once so plentiful, are now seldom seen. This is attributed locally to the exceptionally severe winter of three years ago.

The fish-supply is quite on a par with that of game. Practically all lakes and creeks are well stocked with trout of varying sizes up to 10 lb. Quesnel Lake far exceeds this, rainbow weighing up to 16 lb. and char even to 40 lb. The largest fish taken by us measured 35 inches in length.

Moffat Creek and along Old Wood Jam Road.

In the vicinity of Moffat Creek there are suitable lands available for settlement in small scattered areas. A large proportion of the lower lands, flooded by beaver and overgrown with a dense underbrush, carry a black muck soil, usually underlaid with sand of varying texture. The ground rises from the creek in benches, where a medium sandy soil of yellowish appearance with a fine whitish to yellowish-grey sandy clay subsoil is usual. Stony, even rocky lands are quite common, and above only applies to the better portions of a naturally broken territory. What has been said of Moffat Creek applies to lands to which the Old Wood Jam Road is tributary, only the proportion of rock to soil is greater in the latter. Soils formed by weathering of rocks on the innumerable small hills have through centuries been washed and deposited in the hollows. In addition, often small lakes and ponds have been created in these places, around the shores of which are found soils limited in extent, but rich in humus.

Wood Jam Ranch and Vicinity.

Range lands comprise the prevailing feature in the vicinity of Wood Jam. The ranch itself, which is spoken of almost as a mile-post, consists of about 600 acres, mostly range. At some comparatively recent date, a fire, said to have been caused by lightning, swept the hills west of here and south of the river, leaving little in its wake for the settler to remove. Mr. McKenzie (Wood Jam) has experimented two years with alfalfa, but has only had partial success, although his experiments lead to the belief that, once established, alfalfa will be profitably grown. Hundreds of acres along the Horsefly River are flooded annually, a major cause for delayed spring operations. There has been some desire on the part of local farmers to have investigation made with a view to ascertaining the feasibility of shooting out the so-called "canyon" which is said to be responsible for this backing-up and resulting inundation. It has been said, if this were scientifically and economically performed, Horsefly River ought to pay its way by surrendering sufficient gold from the canyon to deplete expenditure. To say the least, this is very questionable. Such soil as there was a possibility of examining in the very little time at disposal, without interference with customary survey operations, proved to be a silty clay loam with little or no variation to a depth of 28 inches. It displayed slight acidity, no carbonate action, a considerable colloidal content, and in places a decided inclination to bake, though not so cohesive but what it would respond to ordinary cultivation practice. That specie of clover of which mention has already been made is very abundant in places.

The residents of aforementioned districts, in addition to some who reside on the shores of Quesnel Lake, receive their mail at Harpers Camp, where also the majority purchase supplies. Harpers Camp has recently acquired a second store, the proprietor of which, A. Campbell, is expecting a fair business and has made provision accordingly. Freight charge from Ashcroft to Harpers, at the lowest possible rate, is 4 cents per pound. The round freight journey takes approximately one month, and, as there is now only one freighter on this road, it is a slow and tedious freight route. Supplies can be obtained in much less time by Inland Express to 150-Mile House and by stage from that point. This, however, is much more expensive and inadvisable unless in cases of absolute necessity. Mutton is worth 22 cents per pound at Harpers Camp, and whilst beef is not for sale locally, it can be obtained at 150-Mile House, for 16 cents.

QUESNEL LAKE.

Quesnel Lake is remarkable for scenic beauty and notable for historical relationships. Its expansive waters are well stocked with trout and char and its neighbouring hills teem with animal life. Although agricultural land along its shores between Horsefly Bay and Quesnel Dam is practically *nil*, in a few places settlers have established their homes.

These, most of whom make a living through trapping in their endeavour to become to a large extent self-supporting, have grown fruit, beautiful and in quantities far in excess of their needs, while their gardens this summer were a pleasure to gaze upon. Here frost had had no sway, the huge expanse of water no doubt controlling the temperature. The soil is usually of a brownish-yellow appearance, a sandy loam with clay predominating occasionally. All gradations in texture can be found from coarse gravel to silt. Much of the soil at first glance appears to be wholly gravel, but on closer examination much finer material is determined. Although the subsoil is finer, there is still a tendency for the soil to dry out; much therefore depends on rainfall. There are probably 1,000 acres near the mouth of Horsefly River of very good land that should be eminently suited to fruit-growing. This amount might be doubled at some future date should Quesnel Dam ever be removed. Quesnel Dam (at the foot of Quesnel Lake) was originally constructed to retain the waters of Quesnel Lake for brief periods while the gold was being removed from the bed of Quesnel River. From all reports the scheme was an absolute failure, and the dam, which assuredly was a great undertaking for a mining company, remains, serving no purpose, but holding the lake at from 10 to 12 feet above its natural level. The dam itself will resist all nature's attempts at reduction for many years to come, but the gates are already giving, and their entire failure, unless given attention, may be expected any time. In such an event it is difficult to predict the ensuing consequences. It seems highly probable the current will cut away the bank on the north side of the gates (indeed, this is already taking place) and form a new channel. As the bank at this point and for some distance below is high and steep, the wagon-road which traverses the side-hill would naturally be damaged. If the lake should become rapidly lowered it is quite probable the freeing of such a huge volume of pent-up water would do damage at points lower down the river. Evidence of the former lake-level is visible everywhere. Standing dead timber out in the lake (at Horsefly Bay to distance of half a mile), almost total absence of beach where formerly it is said an auto might have been driven, and also Mitchell's Landing on the north side of the lake, where pack-trains were disembarked in early days after being ferried across from Mitchell's Bay, all furnish ample proof. This landing is now observed from a boat submerged in 8 feet of water and some distance offshore. As the dam only adds 12 feet extra head to the river, which itself is a straight run of white water, there seems to be little possibility of the dam ever becoming essential for power purposes.

At various times during the summer, more especially while journeying between Squaw Flats and Quesnel Lake, holes of 20 feet or so in diameter and several feet deep were remarked, as also others of more diminutive dimensions. The larger ones no doubt are of ancient Indian origin, the kind usually known as "kikalie holes," while it is assumed the smaller ones rendered service in the performance of culinary operations. There are now no Indians nearer than the Cariboo Road.

I have, etc.,
F. BUTTERFIELD, B.C.L.S.

NORTH-WESTERN LILLOOET DISTRICT.

BY FRANK TUPPER.

November 23rd, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report on the work done by me in the Lillooet-Cariboo District during the past season:—

The land surveyed is scattered over a large extent of country and necessitated a considerable amount of travel by wagon and pack-train. Commencing near the west end of Williams Lake and extending southerly along the Fraser River Valley, I surveyed eleven pre-emptions and four

Government lots. Six of these lots lie north of the 52nd parallel in the Cariboo District, and the balance to the south of the said parallel in the Lillooet District. Having completed the survey of all the unsurveyed pre-emptions in this locality, I then moved camp to Brittany Creek, in the Chilko Lake country, Lillooet District, where I surveyed three pre-emptions and two Government lots. From here I moved to the vicinity of the Big Creek Post-office, also in the Lillooet District, where I completed the survey of nine pre-emptions. The total acreage surveyed during the season was 4,944 acres. Owing to the scattered nature of the work a large amount of tie traverse was necessary, and no less than 42.5 miles of such were run.

Agricultural Possibilities.

With regard to the land surveyed along the Fraser River Valley, and which consists for the most part of stony hillsides with bunch-grass and elevated benches, I found the soil on the benches to be of good quality, but irrigation is necessary to make a success of farming operations. With water this soil is capable of growing almost anything, as the elevation is comparatively low and summer frosts are not frequent. At Four-mile Creek, on the ranch of Dr. C. Boyd, very fine crops of oats, barley, alfalfa, and vegetables of all kinds, including tomatoes, are being successfully raised under a small system of irrigation.

Brittany Creek.

This country is fairly level and thickly timbered with small jack-pine, and is interspersed with patches of swamp and meadow land of more or less limited extent, from which considerable quantities of wild hay can be cut. Outside of these meadows, however, and extending eastwards, the country is of the poorest possible description. A great deal of it has been swept by a fire in recent years, and in places this burnt country extends for miles where nothing remains but dead jack-pine and bare rock, what little soil there was having been burnt off. The elevation is high, somewhere in the neighbourhood of 4,000 feet, and we experienced severe frost almost every night we were in this inhospitable country. Farming here is an absolute impossibility.

As regards stock-raising, although I saw very little country that could be classed as summer range, I was told by one of the settlers, F. Angers, that there was good range country on the north side of the Chilko River. There is also a strip of fair range country running along the south side of the Chilko River from the mouth of Brittany Creek to Chilko Lake. Mr. Angers plans to put up winter feed at his meadow on Lot 4866 and to run his cattle over the above-mentioned range country during the summer months.

Big Creek.

There are quite a number of settlers on Big Creek, in the vicinity of the Big Creek Post-office, where stock-raising is the principal occupation of the settlers, but fair crops of oats and roots are successfully raised. Potatoes are not a regular crop on account of the uncertainty of the season, summer frosts being somewhat frequent. H. E. Church, who owns the ranch at the Big Creek Post-office, goes in for dairying on a somewhat extensive scale, and was turning out about 500 lb. of butter per month at the time of my visit. This butter commands a ready sale at Hanceville, Alexis Creek, etc.

The pre-emptions surveyed in this locality are distant some miles south and south-west of the Big Creek Post-office, where the elevation is somewhat higher. They consist for the most part of isolated patches of meadow land situated usually several miles apart, there being no two claims adjoining. They are all connected, however, by a wagon-road which is rather rough and rocky throughout. The country surrounding these pre-emptions is poor, being of a rolling nature with light soil, very rocky, and timbered with jack-pine. There are occasional open patches of grass land which make fair summer range. It may be classed as fair stock country, but farming is not likely to prove a success and is not likely to be attempted to any extent.

Transportation.

The pre-emptions along the Fraser Valley are blessed with a first class road running to 150-Mile House, on the Cariboo Road. This road touches the Pacific Great Eastern Railroad (now under construction) at the west end of Williams Lake, where it is said there is to be a divisional point. Settlers in this locality will, when the line is completed, have easy transportation for their products to the markets on the Coast and elsewhere.

From Big Creek Post-office there is a fair wagon-road to Hanceville, a distance of about twenty-two miles, which is on the main stage road from the Chilcotin country to Ashcroft, etc.

As regards Brittany Creek, the only means of access to this country at the present time is by pack-trail from Newton's ranch, which is situated on the main Chilcotin Road, about twelve miles west of Alexis Creek Post-office. This trail follows up the Chilko River on the left bank to the outlet from Chilko Lake, where there is a canoe crossing. Here it is necessary to take all freight across in canoes and to swim the horses, as the water is of considerable depth and the current very swift. This point is about fifty miles from Newton's ranch.

From here there is a pack-trail known as the "Old Nemiah Valley Trail" which runs in an easterly direction and crosses Brittany Creek in about eight miles.

CLIMATE.

In the Fraser Valley, which is considerably lower than the surrounding country, the summer climate is very favourable for the growing of crops. The winter is cold; occasionally the temperature goes as low as 40 degrees below zero. The annual rainfall is said to be about 15 inches, and 2 feet is about the average snowfall. I was not able to obtain much information about the winter climate at Brittany Creek, but on account of the high altitude the winters, I think, would be very severe. During the summer, at the time of my visit, the days were perfect, but, as I before stated, we had severe frost almost every night. The annual rainfall is said to be about 16 inches. At Big Creek the summer days were perfect weather, with occasional frosty nights. The winters are said to be very cold, with about 2 feet average snowfall.

GAME.

In all the different localities in which I was working this year game was exceedingly scarce. A few ducks and an occasional grouse were about all that were to be seen. In some places deer, I was told, were very plentiful in the fall. Fish, however, were plentiful in all the streams, rainbow trout being the most common variety.

CONCLUSION.

In conclusion, I would say that with irrigation the bench land surveyed in the Fraser Valley is very suitable for farming, and that the settlers here will shortly have transportation and a ready market for all they can grow. As to Brittany Creek, farming is an impossibility, but stock-raising may prove profitable for one or two ranchers, as the amount of summer range appears to be very limited.

Big Creek country may be classed as a fair stock country, but farming is not likely to prove a success and is not likely to be attempted to any extent.

I have, etc.,

F. TUPPER, B.C.L.S.

LILLOOET DISTRICT.

BY W. S. DREWRY.

December 17th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to report that in accordance with your instructions I proceeded to Lillooet District and surveyed a number of pre-emptions.

BEAVER DAM AREA.

Work was first undertaken in what is known as the Beaver Dam section, embracing the basins of 57 and 59 Creeks, west of the Cariboo Road. Much of this area had been previously surveyed, a considerable acreage being apparently held by grant from the Crown. It is an exceptionally fine section of country for cattle; and sheep would probably do well, since there is much open pasture in addition to a considerable number of meadows. The pine and poplar forest is quite open and the surface generally fairly level. At present the range is used almost exclusively for cattle.

Good trout-fishing may be had in both 57 and 59 Creeks; the fish in the former being more numerous, but those in the latter averaging larger in size, some of them reaching a pound in weight. Very little sign of game was observed in the woods, the absence of grouse of all varieties being noticeable, although a few years ago they were quite plentiful throughout the tract.

Deposits of carbonate of magnesia were observed in various localities, but considerable of it appeared to contain so much impurity as to make its value doubtful. In the vicinity of Meadow Lake these deposits are said to be of good grade and marketable.

The Bonaparte Country.

The next section of country visited was east of 70-Mile House, along what is known as the Currie Road, leading to the forks of Bonaparte River. This also is a range country suitable in parts to dairying and grazing, containing numerous meadows and lakes.

The waters of some of the lakes hold upwards of 2 per cent. of soda in solution, and are consequently not suited to human use, although freely partaken of by cattle or horses. It is possible that by pumping and the use of evaporating-pans a considerable quantity of carbonate of soda might be recovered in an inexpensive manner, which would pay settlers who would not be required to devote their whole time to its recovery.

Lying south of Currie Road, toward Bonaparte River, is a considerable tract of country unmapped and only partially explored. A hurried trip seemed to indicate that some good open poplar land lies along the slopes of Bonaparte River. This area could be easily opened by a short road from the bend of the Cariboo Road, north of Chasm Creek, toward the mouth of Fly Creek and the settlement about the forks of Bonaparte River.

The whole Bonaparte country seems to be primarily a grazing and dairying country capable of producing good fodder-crops.

Bridge Creek and Canim Lake Country.

Under your telegraphed instructions a long move was made to Canim Lake, where a dispute had arisen between the Canim Lake Indians and an applicant for land. After retracing a portion of the Indian Reserve boundary, this matter was satisfactorily adjusted by the survey of 160 acres along the north boundary of the reserve, adjoining its north-east corner. The balance of the land in this immediate vicinity was considered unsuitable for settlement, so no further surveys were made.

In travelling through Bridge Creek Valley from 100-Mile House it was noted that while in 1913 there was but one settler between the Cariboo Road and Canim Lake, now a number of families have established themselves, and fields of grain are replacing the poplar and pine. Other later settlers were building comfortable-looking houses and roomy barns; so that with a post-office and school in operation it seems as if permanent settlement had been accomplished. Several good gardens were noted, although in some localities complaint was made that frost had injured potatoes. As is frequently the case, it appeared to have been low-lying places that suffered, while the higher land escaped.

Silver Lake Valley.

Silver Lake Valley, some four miles north-west of the Canim Lake Indian Reserve and three miles from the Canim Lake Road, was then visited and three pre-emptions surveyed. There is a chain of three small lakes, the most westerly of which is Silver Lake, a beautiful sheet of water about three-quarters of a mile long by about one-quarter wide. These lakes are connected by a small creek, the water eventually discharging from Silver Lake through 111-Mile Creek into Lac la Hache. Rainbow trout are plentiful in the upper and lower lakes, and grayling are numerous in the shallow water along the shores.

Bradley Creek Valley.

From the most northerly of the pre-emptions in Silver Lake Valley a meridian tie-line was run northerly over the mountain three miles and a half to Bradley Creek, where two disconnected pre-emptions were surveyed and tied in. This creek is a considerable tributary of Eagle Creek, flowing into Canim Lake from the north, about seven miles from its westerly end. In places the valley attains a width of nearly half a mile and contains a limited amount of very good bottom land and meadows. At present this locality is rather inaccessible, being reached by a rough Indian hunting-trail some six miles long over the mountain from Silver Lake valley. One settler had a very fair stand of several acres of timothy, but no other attempt at agriculture appeared to have been made.

The valley rises on a very gentle grade from Canim Lake to 2,550 feet above sea, and frost ravages were less apparent in late September than on the slightly higher lands along Canim Lake Road.

RUTH LAKE VICINITY.

Having completed our work in the upper section of Bradley Creek Valley, we returned over the mountain to Ruth Lake, an unmapped sheet of water about two miles and a half from Canim Lake Road, north of Lot 2941, and surveyed a parcel of 160 acres containing Becker Lake, which it is proposed to drain. This scheme appears to be feasible, as there is considerable fall to Ruth Lake, which in turn drains into Bradley Creek.

Ruth Lake, about two miles long by three-quarters wide, is an extremely beautiful sheet of water and contains rainbow trout, which were frequently observed leaping from the water in considerable numbers. The lands east and west of the lake are high fir-clad ridges, but there is said to be very good land at its northerly extremity. Along the southerly end are small stretches of poplar-flats lying from 50 to 100 feet above the lake.

On the west side of Becker Lake there is a fine poplar-flat; but to the east the country rises in high granite ridges clad with fir. It was noted that the granite was of unusually fine texture, and if transportation were available would no doubt be of value.

A road has been constructed from Canim Lake Road to Ruth Lake, with the intention of continuing to Bradley and Eagle Creeks, which, when completed, will open up some good country now quite difficult of access.

While in the vicinity of Canim Lake a trip was made to Jim Creek, flowing from the south into Canim Lake, where B. McNeil has a farm of 165 acres cleared and mostly broken. A very fine garden of some 3 or 4 acres was particularly examined as showing what the locality is capable of. At Canim Lake Reserve it was noted that frost had cut down potato-vines; but at Jim Creek there was no indication of frost, most of the garden vegetables common to the latitude being well grown, including tomatoes just beginning to ripen.

Young apple-trees appeared to be thriving, having made good growth during the season. Some varieties of flowers and roses had also been grown. These exceptional conditions at an elevation of 2,550 feet above sea-level possibly arise from the fact that Canim Lake is about three miles wide at this point, and the large body of water may exercise such a tempering effect that frosts experienced in surrounding country away from the water are not felt.

The trip and examination were undertaken because there is a tract of some 2,000 acres near Mr. McNeil's farm, which, although timbered, might well repay the labour of clearing and prove the foundation of a prosperous small settlement.

93-MILE CREEK.

Having completed work in the Canim Lake section, we returned to 93-Mile Creek, on the Cariboo Road, camping at the crossing immediately adjoining, where we surveyed a very excellent pre-emption containing over 100 acres of meadow. The southerly portion is dry, while the northerly portion was wet in spite of a considerable fall to the south. This apparent paradox is perhaps explained by the fact that during part of the year the creek shows running water at the road crossing, but sinks within 100 yards, reappearing probably in the shallow lake on the easterly boundary of the land surveyed, whence it runs as a creek in a well-defined channel for a few hundred yards, and again sinks for a considerable distance. The northerly portion of the meadow is divided from the southern part by a dam partially natural and, it was thought, partly ancient beaver-dam which holds the water back. A channel cut through this dam and a few drains leading to it would render the whole of the meadow good hay land, and make this one pre-emption capable of carrying upwards of 100 head of stock, using surrounding country as summer range.

There are other 160-acre lots unsurveyed along this valley almost equally as good as that above described. The altitude approaches 4,000 feet above sea-level so not a great deal can be expected in an agricultural way; but timothy and clover will grow luxuriantly, as is amply proved by what has taken place about the old road camp at that point. This fact is important as there is a considerable acreage of good land east of the Cariboo Road in this vicinity.

I have, etc.,

W. S. DREWRY, B.C.L.S.

VICINITY OF PACIFIC GREAT EASTERN RAILWAY, BETWEEN PEMBERTON AND LILLOOET, LILLOOET DISTRICT.

By George S. Boulton.

October 29th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit the following report on surveys of pre-emptions lying between Pemberton and Lillooet, and also in the Fraser River Valley between Lillooet and Texas Creek:—

The first work undertaken was the survey of six pre-emptions on the west side of the Fraser River between Lillooet and Texas Creek. A. F. Hautier, since taking up his pre-emption on the south side of Texas Creek, has made considerable improvements; he has about 40 acres of level bench land, and this, together with the adjoining lot on the east which he has purchased, should make a very fine ranch. None of the other pre-emptions contain agricultural land to any great extent.

There is a good road from Lillooet to Texas Creek running through several ranches on which large crops are grown.

Two pre-emptions were surveyed on Seton Lake, one at the east and the other at the west end of the lake. The country along both sides of Seton Lake is very rugged and broken, and what land there is of any agricultural value has already been alienated from the Crown.

At the portage between Seton and Anderson Lakes are several small ranches which are being developed; the ranchers here are devoting their attention chiefly to fruit. Several pre-emptions were surveyed along the west side of Anderson Lake, taking up the balance of land of any value. The country to the east of the lake for almost its entire length is of a very mountainous nature, rising steeply from the shore. From the south end of Anderson Lake along the valley of the Gates River are a number of small ranches, the owners in the majority of cases being on active service.

Leaving the wagon-road about a mile from D'Arcy Station, near the north boundary of Lot 3127, a good pack-trail runs to Blackwater Lake, a distance of five miles and a half, and on to Birkenhead Lake, another four miles and a half. Traverse connections were made along this trail, linking up the various groups of surveys in this vicinity.

The Pacific Great Eastern Railway are now operating three trains a week each way during the summer from Squamish to Clinton, and two trains a week in the winter.

There is a good stand of timber—fir, spruce, cedar, and pine—in the country adjacent to D'Arcy which will create quite an industry when logging operations are commenced.

Considerable activity in mining is being displayed, and this district is being thoroughly prospected, development-work on the properties on McGillivray Creek being carried out.

As summer resorts Anderson and Seton Lakes merit attention from the public; trout-fishing on the lakes and in the creeks is excellent. Good accommodation is to be had at D'Arcy and also at the east end of Seton Lake.

I have, etc.,
George S. Boulton, B.C.L.S.

UPPER NORTH THOMPSON VALLEY, KAMLOOPS DISTRICT.

By W. G. McElhanney.

October 18th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit the following report of this season's surveys on the North Thompson River, north from Clearwater River:—

The valley of the North Thompson River is narrow, averaging about a mile in width. During the construction of the Canadian Northern Pacific Railway most of this land was alienated either by pre-emption or purchase. Many of these pre-emptions were occupied and improved, houses and barns built, and some clearing done. There were ties and bridge-timber

required for the railroad, and these were largely obtained from the pre-emptions, so that the work of the settlers was profitable. But with the close of construction this market fell off, and the settlers found difficulty in getting enough land cleared and in cultivation to make a living. A great many held on till they had completed their pre-emption duties and obtained their Crown grant, by which time their finances and their courage were at a low ebb, and the war and increased industrial activity elsewhere opened an avenue for many of them to leave. I would roughly say that two-thirds of the pre-emptions are now vacant, with cleared land going back to its original state and houses and buildings going to decay. Some of this land is good, especially that in close proximity to the river; but clearing is costly, and with the exception of cedar poles, railroad-ties, and in some cases shingle-bolts, there is no market for the timber on the pre-emptions. Mills or industries are required where men can find employment during part of the year, at least while living on and improving their holdings. There are individual cases of enterprising men who have held on, cleared land, and acquired enough stock to be able to live fairly comfortably. Garden produce does very well and expenses are not heavy.

The pre-emptions which I surveyed this year are mostly at the outskirts of the valley land, a small corner being flat or valley land and the remainder on the hillside. The hillsides are, as a rule, very thickly covered with a dense growth of small hemlock, spruce, cedar, birch, and poplar which has sprung up since the great fires that swept the hillsides bare. This land in its present state is of little value. It is impossible to clear these hillsides economically except by wholesale burning of large areas, and it would then be most suitable for grazing if seeded at once. The small area that can be cultivated is, in nearly all cases, all that the pre-emptor uses, and the remainder is only of value to him for any timber that he may be able to use from it or to obtain control of certain water privileges.

In the vicinity of Messiter, near Hell's Gate Canyon, the four pre-emptions I surveyed this year were mostly on a stony hillside separating the North Thompson River and the north branch of Salmon Creek. This hillside is covered with a light growth of poplar, easily cleared, but having very little land of agricultural value. The portions in the valley of Salmon Creek are better land, but this is heavily timbered with cedar and hemlock, is very wet, and the cost of clearing and drainage would be heavy. Only small portions of each pre-emption could be cultivated, and the remainder would be most suitable for grazing land.

At Avola there is one of the best mill-sites on the river at the mouth of a slough. The current is sluggish here and logs and shingle-bolts can be easily held. A shingle-mill has been in operation here for the past two years, but is now closed. There is some good land on both sides of the river, both above and below Avola, but it is subject to overflow. I surveyed three pre-emptions in this vicinity, each having a few acres of good level land and the remainder steep hillside covered with a thick growth of small timber.

Around Wire Cache two pre-emptions were surveyed. These belonged to soldiers on active service and were for the most part bench land or hillside timbered with tie-timber, the land being gravelly.

Vavenby is one of the oldest settlements on this portion of the river. Land has been occupied and cultivated here for over twenty years. The most of the valley land has been taken up previously, and the land surveyed this year, consisting of six pre-emptions, is almost entirely on the hillside and is most suitable for grazing purposes. There is a great deal of thick brush interspersed with scattered fir suitable for tie-timber. The timber is more scattered here than farther north, and grazing is better. The most of the pre-emptions were being acquired by adjoining owners who required additional land for cattle or sheep. The sheep industry is being carried on here quite extensively by one man who has a flock of about 500. These range on the top of the mountain in the summer in care of a shepherd, and are fed in the valley in the winter with hay grown on the valley lands. This country is mineralized and extensive prospecting is being carried on this year. A mine has been opened up within a mile of the railroad and shipments are likely to be made soon.

At Birch Island I surveyed only one pre-emption on a bench about 600 feet above the railroad. This land has been burned over and has grown up with poplar and willow. The land is rolling, somewhat stony, but appears productive, and is freer of frost than the low-lying land adjoining the river. There is considerable mining development here. A wagon-road has been built from the railroad for seven miles up the mountain, where development-work is proceeding

on a large deposit of low-grade copper. Should the results be satisfactory it will aid materially in the development of this district.

The remainder of our work was in the vicinity of the Clearwater River, where we surveyed four pre-emptions. The soil here is light and inclined to be stony. It is not very suitable for agricutural purposes, but more for grazing.

The climate in this portion of the North Thompson Valley is wetter than around Kamloops, but still not so wet that irrigation can be dispensed with. Occasional frosts occur during the summer, but these are less harmful on the bench lands than along the river. The snowfall is from 18 to 24 inches on an average. Summer months are usually fine, with plenty of sunshine and rapid growth.

Vegetables and small fruits can be grown almost anywhere in the valley. Apples are produced as far north as Vavenby. Less hardy fruits do not thrive well on account of the frosts. Hay is a staple crop, and where sufficient irrigation can be obtained gives good results, two crops at least being obtained. Summer feed is scarce, as the hillsides are too thickly covered with brush.

Game is scarce in the valley, but on the mountains adjoining there are bear, caribou, deer, etc.

At present this district is very backward on account of so many settlers being away at the war or engaged in some allied occupation, but with conditions normal again there is room for a limited number to engage in general farming, stock-raising, mining, and lumbering.

I have, etc.,
W. G. McElhanney, B.C.L.S.

LOWER NORTH THOMPSON VALLEY, KAMLOOPS DISTRICT.

By J. E. Ross.

November 22nd, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit the following report in connection with my survey of pre-emptions on the North Thompson River:—

The work was a continuation of last season's. The country in general is somewhat similar, but there is less open grazing land and the hills are more rugged and heavily timbered or covered with a thick growth of brush.

I found the pre-emptions to be surveyed were even less favourable for farming than those of last year. Some of the pre-emptions had not been occupied or improved; some had been occupied intermittently and very little improved; some rather isolated, and others so inaccessible that it was impracticable to reach them with a good wagon-road. Only a few were suitable for farming.

Your instructions were to the effect that only pre-emptions actually occupied or held by pre-emptors in military service were to be surveyed, and that lands not particularly suitable for settlement were not to be surveyed. In carrying out the instructions I found it necessary to survey only about one-third of the number allotted to me. On the remaining ones I reported the particulars as fully as I knew.

The soil on the hills and benches is sandy and gravelly. Except the land has a considerable depth of black soil or sufficient water for irrigation, it is not worth taking up. It seems a pity that so much time and work have been expended on the uplands while there are thousands of acres lying idle along the river-banks. One reason that these bottom lands have not been settled on is that they were held at a high figure some few years ago, though such does not appear to be the case at the present time. The cost of clearing, which would reach $100 per acre in some parts, is another obstacle.

Lumbering was very brisk in this section. Several sawmills and logging camps were in operation. Besides lumber and railway-ties, a considerable quantity of electric poles, piling, and fence-posts are shipped from here. At the present rate of cutting, the timber in this part will be exhausted in a few years. The marketable timber comprises fir, pine, cedar, and spruce.

Quite a revival in mining has taken place lately on the North Thompson. More substantial development-work has been done during the past year than ever before. At the Queen Bess

Mine, near Blackpool, quite a force of men was engaged all summer. They had just completed a 400-foot tunnel leading to the main body of ore while I was in the neighbourhood. The manager was greatly pleased with the result. At Birch Island a wagon-road seven miles long had just been finished to the Lydia Mines. Since then machinery has been hauled up and a plant installed. A vaulable discovery near Vavenby has been quite recently reported. The coal-mines near Chu Chua, from which coal was shipped some twenty years ago, are to be tested by diamond-drill as soon as they are out of litigation.

Game appears to be gradually getting scarce. We only noticed several deer and a few grouse.

The Canadian Northern Railway, with stations every six or seven miles, has proved a great convenience to the settlers, but the mail service is poor, and while the mail clerks' strike was on it was very bad.

My survey operations were carried on under considerable difficulty, chiefly on account of the scarcity of suitable men. The mosquitoes were not more numerous than usual, but rather more persistent for reasons that I am not able to explain. Drinking-water was scarce on the hills owing to the dry weather in the first part of the season. During August the brush was wet almost continuously.

I have, etc.,
Jos. E. Ross, B.C.L.S.

WHITE VALLEY, SOUTH-EAST OF VERNON.

By F. H. Latimer.

November 20th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—Work was commenced on a group of pre-emptions lying south of the Coldstream Ranch, chiefly held by men on war service. A wagon-road leads up past Coldstream Ranch stables, with branches to several of the claims, the grade being 7 to 15 per cent., with some short steep rises up which a car can be taken with difficulty. Towards the end the grades and condition of road become impossible, except for a powerful team and light load.

Considerable wood has been taken out from some of the claims as obtained in the process of clearing, but not much other work has been done on any of the claims beyond building good cabins, also stables in some cases, and small clearings of 1 to 2 acres. All but one claim is covered with brush and timber, so that the problem of getting the land in condition for crops will be heavy, $50 to $80 per acre. Water is obtainable on all the claims, either from small streams or springs or from wells sunk in hollows.

A portion of the south end of three claims—Pre-emption Records 6482, 6581, and 6563—lies on a high rolling plateau which rises towards the south in rock cliffs varying from 75 to 150 feet in height. This plateau, so far as explored, is covered with jack-pine and balsam, with numerous natural wild grass meadows, swales, and swamps, on or around which is found thick alder, willow, birch, spruce, and balsam and occasional mountain-ash. These latter could be cleared and the necessary drains made without much difficulty, and could be made to produce considerable hay.

Access can be gained to this plateau conveniently, either up the east bank of Deer Creek in Section 8, Township 6, through a break in the cliff a short distance east of the centre of Section 4, or by way of the road and pack-trail which leads from the Coldstream Ranch through Sections 10 and 3 towards Aberdeen Lake.

The general slope and creeks on these claims fall towards the north, some of the smaller streams sinking on reaching the bottom lands of the main valley, excepting during high water.

After moving camp eight miles and surveying one pre-emption in Section 2, Township 9, in vicinity of Cousen's Bay on Long Lake, camp was moved to Section 6, Township 3 (elevation 3,400 feet), on south slope of a group of high rock peaks called by some "Bluenose," which form a prominent landmark when coming out from Vernon on the White Valley Road.

Five claims were surveyed in the vicinity of this camp, two of which are being occupied and improved and cultivated, the remainder being held by men overseas. All these lands have been covered with timber at one time, but have in considerable part been overrun by fire, and

in South Half of Section 12 has left very little except standing dead stubs, windfall, and a heavy second growth of willow, tamarack, and alder. On the remainder the timber is chiefly tamarack and fir, with the addition of cedar, balsam, and a little spruce next the streams or in hollows, but not in commercial quantities. In most cases the disposal of the wood as cord or stove wood will assist in carrying the settler along while clearing the land, though the haul to the only market—Vernon—is about thirteen to fifteen miles.

A good wagon-road (excepting that grades run up to 12 or 15 per cent. in some places, going south) runs from the main valley through Sections 7 and 6 to south-west corner of Lot 4162, from whence one settler's wagon-road leads through Lot 4174 to Lot 4175, the other branch going south to north-west corner of Lot 4172, continuing from the latter point southerly to a group of lakes, swamps, and natural meadows, including Summit Lake, Fish Lakes, Haddo Lake, and Aberdeen Lake. On the two latter, dams have been constructed to store water for the Grey Canal, these lakes being one of the sources of Jones Creek, from which creek the Grey Canal is diverted near the south-west corner of Lot 3654 (in Section 8, Township 3).

Having completed the survey of these claims, camp was moved to near a watercourse close to south-east corner of Lot 3521, from which three claims were surveyed and designated as Lots 4528, 4530, and 4531, all of which are held by men overseas. Not much work has been done on any of them except in building cabins, small clearings, and making trails on which to get from wagon-road to the cabins.

The well-cut-out pack-trail previously mentioned as leading from the Coldstream Ranch to Aberdeen Lake passes diagonally across Lot 4530. I have been informed that much of the cement and supplies required in construction of dam on Aberdeen Lake was packed in over this trail.

In general, these claims are situated on a high rolling plateau covered with jack-pine, some tamarack and balsam, with many natural hay meadows, marshes, and lakes, in the latter of which is good trout-fishing. The clearing on these meadows is generally light, and the soil a deep black loam or muck that can be easily drained.

The elevation of this plateau is rather high (about 3,400 feet) and is subject to late spring and early fall frosts, though the first frost this season was on September 25th, and the first snow in Camp No. 4 being a light fall of 1 inch on October 22nd, followed by a fall of 2 inches on October 23rd and 24th.

Camp was next moved to vicinity of south-east corner of Lot 3654 (Section 9, Township 3), the distance in an air-line from Camp No. 3 being two miles, but requiring a travel of fourteen miles by way of Lots 435, 432, 436, and 3654, owing to intervening deep valley and canyon of Jones Creek and existing roads. The last half a mile before reaching camp is up a very steep, rough, and sideling settler's road, though a good road can be made with moderate expense, the distance from Vernon by most direct route being sixteen miles. The elevation of this camp was approximately 2,790 feet near H. Ashman's house.

Four claims were surveyed from this camp, two of which are for men overseas. These claims have also been all covered with timber-growth, chiefly consisting of tamarack and fir, with addition of considerable cedar and balsam in creek-valleys. Jones Creek lies to the west of this group, and along the east an unnamed small tributary of Harris Creek runs. At the time of survey there was only running in this latter tributary about ¼ second-foot, but the appearance of the creek-channel would indicate that the stream must be of considerable size during high water.

Portions of these claims are on high knolls or ridges, on which the soil is light, with considerable rock, but the benches are of a clayey loam, and there are indications of considerable underground seepage coming out as springs near the creeks mentioned in preceding paragraph.

Heavy rains set in while at this camp during the last week of October and first week in November, accompanied by thick mists, the rain showing as snow at an elevation of about 1,500 feet above camp.

Very little game was seen this season, though numerous deer-tracks were observed to the east of Long Lake and some on Upper Jones Creek. A few black bear are in the vicinity, and a limited number of blue, willow, and Franklin grouse.

Timothy was seen growing in many places over or in the vicinity of the pre-emptions surveyed, particularly near Camps 3 and 4 on Lots 4165, 4162, 4173, 4163, 4164, 3521, 4174, and 4175, also in Sections 9 and 10, Township 6.

I have, etc.,

F. H. Latimer, B.C.L.S.

VICINITY OF SUMMERLAND, OSOYOOS DISTRICT.

By B. A. Moorhouse.

December 17th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit the following report on my season's work during 1918 in the vicinity of Okanagan Lake:—

Following your instructions, surveys were made of scattered pre-emptions, some of which had been held under record for a number of years, situated on the west side of Okanagan Lake from the Municipality of Summerland on the south to Wilson's Landing on the north, which latter point is nearly opposite Kelowna. This district takes in the towns of Summerland and Peachland, and also the smaller settlements of Minneola and Altamont on the west and Glenrosa and Westbank on the north.

Owing to the district being well supplied with roads fit for motor travel, which connect the settlements and also have branches up most of the small valleys down which the numerous creeks flow to Okanagan Lake, the lands under consideration are more accessible and to that extent more valuable than the majority of pre-emption holdings in some parts of the Province.

Generally speaking, the lands in the valleys nearer Summerland are already planted to orchards and yield splendid crops of the best fruit and other produce, as they have a successful irrigation system practically ensuring certain harvest each year.

The first camp was located one mile west of Faulder, which is a small station on the Kettle Valley Railway about seventeen miles west of Penticton, on the Coast-Kootenay branch of the Canadian Pacific Railway, and about ten miles west of Summerland by road. From Faulder this road turns north to Fish Lake, about eight miles up the Darke Creek Valley, passing through the little sawmill town of Minneola, about half-way. Minneola has a school, post-office, store, and a few good houses and many other buildings surrounding the sawmill.

The land to be inspected before survey operations were possible was so grouped at great distances apart that it is only possible to report upon the same in groups.

In the valley of Darke Creek, in which Minneola is situated, all the bottom and side-hill lands are rapidly being denuded of the merchantable timber, leaving the lands in an easier state for preparation as farm and orchand lands, which will be possible as soon as a successful irrigation system is completed.

In the southern portion of the valley below Minneola sawmill there is at present very little of even the bottom lands under cultivation, as all the water from Darke Creek is used by the sawmill, thus depriving land-owners of water for agriculture; but to the north of Minneola some of the land at present under cultivation suggests the possibilities and proves the producing value of the land even under the uncertain flow of water for irrigation from Darke Creek.

Five pre-emptions and three lots were surveyed adjacent to the townsite of Minneola; the soil on the benches and hillsides being a good sandy loam, excellent for fruit land if irrigation could be applied thereon. The majority of the lots contain excellent pasture, and on some parts hay and other crops could be grown when the normal supply of water from Darke Creek is again available.

The sawmill at Minneola has about completed its work of cutting timber from some 2,000 acres of land, most of which is now semi-ready for irrigation, and some of the surveyed lots along with the longer-established pre-emptions will likely be divided into small fruit-farms when a comprehensive irrigation system is assured.

Two pre-emptions were surveyed nearer to Fish Lake, the owners having done considerable improvements.

Four places were surveyed to the west of Faulder as far as Canyon Creek and on the south side of Trout Creek, which lands lie at an elevation of from 500 to 800 feet above Trout Creek on the summit between it and Shingle Creek. A fairly passable road goes through this property and connects with both Penticton and Summerland.

The land here was mostly used for range. There were some 200 sheep and many cattle pasturing there this summer. The accessibility to water is of prime importance, and for this reason the survey of Lot 4457 was diverted from usual methods in order to utilize Trout Creek.

This district is very park-like, slightly sloping to the north and south from the summit,

where several small lakes and a few excellent springs are to be found. The timber is mostly fir and pine scattered over the land, intermingled with dense patches of young willow and other growths. This part of the country appears to be a sportsman's paradise, as deer and duck have been found there in large numbers.

Some pre-emptions directly north of this district across Trout Creek were inspected and found to be at present not sufficiently useful to warrant survey, the barren hillside lands being particularly dry, as all the springs during the last few hot summers have disappeared, to the detriment of the land-owners high up near the summit.

Three pre-emptions surveyed were within the limits of the Municipality of Summerland, the owners all appreciating the value of having their places surveyed. The proximity of these lands to the 10 acres of orchards make them particularly useful for near-by pasture lands.

In all, eighteen places were surveyed from Camp No. 1 and seven inspections made.

Camp was moved by the Kettle Valley Railway up to the Trout Creek Valley a distance of fourteen miles to Altamont, a busy sawmill community at which there is a store, post-office, many houses, and station, etc. The mill here has turned the timber from the surrounding hillsides into lumber available for buildings, etc., and incidentally made the lands more easily prepared for cultivation.

Of the five places surveyed here, four belonged to soldiers who will no doubt return to further develop their lands, as the soil generally is good sandy and black loam, and where irrigation can be placed thereon; fairly level and easily cleared. The hillsides are covered with bunch-grass and make good range for cattle.

An old wagon-road from Altamont to Faulder and also farther west along the railway to Osprey Lake requires some repairs in order that when needed by settlers a fair road can be got to Summerland. Some of these places have small natural meadows easily made irrigable from Trout Creek. On the south side of the creek the hills are densely covered with black pine.

The next move was to Deep Creek, which is close to the southern boundary of Peachland, and along this creek twelve pre-emptions were inspected, of which seven were surveyed; also certain tie lines, etc., made.

These lots to the south of Deep Creek on the adjoining high plateau between Deep and Eneas Creeks are all the property of soldiers, and now used solely for range purposes; but there is some level land with rich black loam soil, and also some small natural meadows which are easily cultivable. The majority of the land is rolling bunch-grass range with scattered fir and pine, with dense clumps of willow and other small brush in places. Water for domestic purposes is scarce.

There is an old construction-road which can be repaired in order to give these pre-emptions access to Peachland when necessary.

Other scattered pre-emptions were surveyed up the South Fork of Deep Creek, most of the lands being covered by dense young jack-pine, except for the natural open meadows to be found near the summit of the divide between Deep and Trout Creeks. The Peachland Municipality and others use the meadows and reservoirs for storage of irrigation-water during the season. There is a fair road right to the summit, where construction of dams has taken place a few years ago.

Surveys were also made up Trepanier Creek, but owing to the absence overseas of owners, these, with many other places surveyed this season, are either idle or used solely for range land; but upon the return of the owners these places should receive a new lease of usefulness, especially when it is realized that the places are now entirely the property of the soldier pre-emptors by Crown grant from the Government.

Inspections were made of Westbank and Glenrosa properties and two places surveyed up near Bear Creek.

The season was exceptionally fine for outdoor work and the district fairly free from forest fires. No summer frosts, and no accidents of any kind occurred.

I have, etc.,

B. A. Moorhouse, B.C.L.S.

VICINITY OF FAIRVIEW, SIMILKAMEEN DISTRICT.

By C. A. E. Shaw.

November 27th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to report that under your instructions I made surveys of a number of pre-emptions between Fairview and the International Boundary-line on that part of the range lying between the Okanagan and Similkameen Valleys.

This range is rolling and broken with deep valleys and a number of small lakes, some of them salt, and one (Spotted Lake) has been worked extensively for Epsom salts, some thousands of tons having already been shipped from it. The hills are usually clear of timber on the south slopes and covered with bunch-grass, but on the north are generally timbered, mostly with fir of fair size and quality, and many of the valleys have groves of cottonwood in them.

The soil of this range is usually of excellent quality, deep black loam with clay subsoil. Dry seasons are the great drawback to this district, the past season being the worst on record in this respect. Many springs and streams were dry for the first time on record, and the crops, where irrigation was impossible, were practically a failure. On this account nearly all the settlers whose land was being surveyed were away from home working elsewhere.

The climate of the Okanagan and Similkameen Valley is mild, with a long summer season. Snow falls on the hills, but very seldom lies in the valleys. The rainfall is light, and summer frosts are practically unknown in the valleys. Where water for irrigation purposes can be obtained, all the tender fruits and vegetables, such as peaches and tomatoes of the finest quality, can be grown in abundance. At Keremeos, for instance, a few miles to the west, where a cannery was built about three years ago, 100 tons of tomatoes a day were delivered during the season; and I have no hesitation in saying that when the Okanagan and Similkameen Valleys are placed under irrigation they will be able to supply not only British Columbia, but also the Province to the east, with all those species of tender vegetables and fruit that are with difficulty raised elsewhere.

Fairview, which is the mail centre for this (Okanagan) district, consists of a post-office, store, and a few houses; the Government offices are also located here. It is situated in the Okanagan Valley about twelve miles north of the International Boundary-line. Penticton, the market town for the district, is about thirty-two miles farther north at the south end of Okanagan Lake. Excellent roads connect the two places, and the Kettle Valley Railway, which passes through Penticton, provides transportation to the Coast and also to the East. Steamers on Okanagan Lake provide access to Vernon and also to Sicamous, on the main line of the Canadian Pacific Railway. There is also a wagon-road from Fairview to Keremeos, sixteen miles to the west, and farther south a road runs through the Richter Pass to the Lower Similkameen. This in the future is intended to form a link in the International Highway. There are also two good roads leading east to the Boundary country—one from Fairview and one from Osoyoos, about ten miles south, where it crosses a narrow point in the lake of that name. The road through Richter Pass connects with this.

Deer are fairly plentiful in the higher ranges of the district. There are mountain sheep and goats in certain sections. Grouse are plentiful. There are scattered flocks of prairie-chicken, and in the fall and winter ducks are numerous in the Osoyoos and other lakes in the valley. Geese are also to be found at times, and in Vaseaux Lake a flock of swans has remained winter and summer for many years. Pheasants and quail were introduced into the Okanagan and Similkameen Valleys about four years ago and are now becoming fairly plentiful. In Osoyoos Lake, which is the lowest point in the interior of British Columbia (986 feet above sea-level), are various species of trout. Carp, which were introduced some years ago, are numerous, and in the fall a species of red salmon from the sea come up in large numbers to spawn.

I have, etc.,
C. A. E. Shaw, B.C.L.S.

NICOLA VALLEY, KAMLOOPS DIVISION, YALE DISTRICT.

By O. B. N. Wilkie.

October 9th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit the following report of the country surveyed during the past season in Nicola Valley:—

Merritt is the principal town in this section and is reached by the Kettle Valley Railway, being forty miles in a southerly direction from Spences Bridge, on the Canadian Pacific Railway. From Merritt the Kettle Valley operates trains through Southern British Columbia, connecting at Princeton with United States railway-lines and giving a direct route to travel from the States through Spokane by way of Princeton to Merritt.

Merritt is a thriving little city of about 1,500 inhabitants, the principal industries being its coal-mines, which furnish employment for a large number of men. Business is represented by two large departmental stores, one drug-store, three general stores, one men's furnishing goods store, two meat markets, and several other smaller shops of various kinds. It has two banks, two garages, and owns its own water and electric-lighting plants.

Agriculture in the Valley.

Merritt is the centre of a considerable agricultural community and good Government roads radiate from it in all directions. General farming is successfully carried on, the land requiring irrigation for the most part to grow good crops.

Dry-farming is being tried out. A dry-farming experimental station established by the Government has been in operation for the past five years above Quilchena, at the head of the valley, at an elevation of 3,800 feet. Splendid cereal crops have been produced there under scientific dry-farming methods. One year it produced a yield of 90 bushels of oats to the acre.

The altitude of the valley within a radius of fifteen miles from Merritt ranges from 1,500 to 2,000 feet, while the upper portion reaches about 2,600 feet. However, farming is carried on at elevations of 4,000 feet in the sections surrounding it, but the ranchers on the higher levels make stock-raising their principal source of income.

Crops grown.

All the staple varieties of vegetables do well in the valley and all small fruits can be grown successfully. It is not considered a fruit district, but certain varieties of tree-fruits can be grown. The Government has a small orchard at Lower Nicola, about five miles below Merritt, and the trees are doing very well. Good crops of wheat, oats, barley, and rye are produced, and hay is a staple product. Merritt furnishes a good market for produce. Poultry does well here and the district is especially adapted for turkey-raising.

Stock-raising.

There are many large cattle-ranches in this vicinity, and practically all the ranchers go in for stock-raising more or less. Sheep-raising is coming to the front and promises to become one of the important industries of the section. Considerable pork is produced. The "porkers" raised here are singularly free from disease and hog-cholera is practically unknown. There is excellent grazing for cattle and sheep in the hills surrounding the valley, and cattle run out on the open range till well along in the winter.

The valley needs a good creamery, and it would undoubtedly be of great benefit to all the settlers.

Climate.

The climate of this valley is certainly one of its greatest assets. Glorious sunshine and clear, bracing atmosphere make it an ideal place of residence for those in search of health. The summers are mild, the nights always cool, while the winters are clear and cold, with medium snowfall. Motor-cars continue in use on the roads most of the winter season. Summer frosts occur very seldom. You may say they are an exception and not the rule.

MINING.

In addition to the coal-mines spoken of above, considerable interest is taken in the development of mining for gold, silver, copper, iron, gypsum, etc., in the territory adjacent. The prospects for the development of the mining industry in general look very promising. Several properties are being worked at the present time.

LUMBERING.

At the lower end of the valley near Canford the Nicola Valley Pine Lumber Company has a large plant, and the getting-out of logs for this mill has been a profitable source of income to settlers. The logging camps up the Coldwater River employ many men. The timber is principally pine and fir, running about 5,000 or 6,000 feet to the acre.

NICOLA LAKE.

Nicola Lake, whence flows the Nicola River, from which the valley takes its name, is one of the beauty-spots of this section. It is seventeen miles long and about two miles wide and is an ideal fishing resort. In fact, all the streams and lakes in this vicinity furnish excellent sport for the enthusiastic trout-fishers.

The town of Nicola is situated at the foot of the lake, and here the Government office for the district is located. It also has the distinction of being the oldest town in the valley. A branch line of the Kettle Valley Railway extends from Merritt to Nicola.

My party proceeded from Merritt by wagon-road to a point near Midday Creek, about six miles in a south-westerly direction. Here we surveyed twelve parcels of land, of approximately 160 acres each, for settlement by returned soldiers. Also some other pre-emptions.

This land has an elevation of about 3,000 feet. It is undulating country with some open land, with groves of small poplars and willows. There are also portions with a fair growth of pine and fir, running about 2,500 to 3,000 feet to the acre.

In regard to clearing the land for crops, it would cost in the neighbourhood of $50 per acre to clear the poplar and willow patches. The pine and fir areas I consider would be unfit for cultivation, but would make good pasture.

Several streams run through these parcels of land which would furnish irrigation in the early part of the summer. They were dry, with the exception of a few pools at intervals, at the end of July. The soil is gravelly loam, very similar to that of the Quilchena Dry Farm. There is a road open into these lands and it is only three miles from Walkerville, a flag-station on the Kettle Valley Railway.

From here we moved to Rey Lake, a distance of thirty miles north of Merritt, a wagon-trail being open to it. Here we surveyed several pre-emptions, principally owned by men on active service. This lake lies at an elevation of 4,000 feet, the country adjacent being undulating, with patches of small poplar. The timber on the wooded slopes consists of black pine and fir, which cannot be considered of commercial value as the fir is not of good quality. Considerable clearing has been made of the poplar groves by the pre-emptors. There are several large natural hay meadows on the east side of Rey Lake on which wild hay is cut and cattle wintered. Summer frosts were observed in August.

From this point we went on to Mamete Lake and surveyed some isolated pre-emptions taken up by men who are now at the Front. The general character of the country is similar to that of Rey Lake, with the exception that the timber is of better quality and the elevation is about 3,200 feet.

There are several large ranches located in the valley adjacent to Mamete Lake.

We proceeded from there to Eight-mile Creek and surveyed a few soldiers' pre-emptions. In this section most of the land cleared is sloping hillside and the elevation is around 4,000 feet. Hay and grain are the principal products. Some sheep-raising is carried on.

From Eight-mile Creek we moved on to the north end of Nicola Lake, where we also surveyed some pre-emptions. With the exception of the lands laid out for settlement by soldiers, our duties throughout the season were mostly confined to the pre-emptions previously taken up by men who are at the Front.

All through this section the lands in the valleys have been taken up years ago and are now productive ranches. Hence, new settlers looking for Government lands must go farther afield. However, throughout all these mountain districts one finds bench land and small valleys which

make good farms when cleared and put under cultivation. We noticed many such small holdings in process of development and found settlers doing well with them. The soil is good, and the many small streams furnish water for irrigation purposes, which can be put on the land at small cost.

Hunters and trappers find a variety of game in the mountains and along the streams. Deer is plentiful, as well as bear, lynx, and coyotes. There are beaver, mink, and ermine along the streams. In the way of game birds, ruffled and willow grouse are here in abundance, and the many lakes provide a happy hunting-ground for ducks and geese in the fall of the year.

A government telephone system connects Merritt with the district and also with most parts of British Columbia.

I have, etc.,
O. B. N. Wilkie, B.C.L.S.

VICINITY OF PRINCETON, KAMLOOPS DISTRICT.

By P. W. Gregory.

November 23rd, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit herewith the following report upon the lands surveyed by me during the past season:—

The work comprised the survey of pre-emptions situated along Allison (One-mile) Creek, Hayes (Five-mile) Creek, and Summers Creek, flowing into the Similkameen River near Princeton from the north.

In all, forty-six pre-emptions were included in your instructions, and, as specified, none were surveyed unless occupied or improved or found to belong to men engaged on military service. Forty only of the forty-six pre-emptions were examined, reported on, or surveyed, when it was deemed advisable to bring the field-work to an end. Of these forty, nineteen only fulfilled the required conditions and were surveyed, whilst twenty-one, being unimproved and apparently abandoned, were not surveyed. Of the nineteen surveyed, five belonged to men absent on military duties, eight only were under occupation at the time of survey, and six were considered sufficiently improved to warrant completion of the surveys.

It would appear unnecessary for me to again describe the district in this vicinity, as it was covered in my report on the season's work for 1916. Mention, however, should be made of the present activity due to railway-construction and mining development. The Kettle Valley Railway has in course of construction a branch line from Princeton to the mine of the Canada Copper Corporation, Limited, a distance of about fourteen miles, which will probably be finished towards the end of next summer.

Three miles south of the town this mining company is erecting a concentration-mill for the treatment of its ores by the oil-flotation process which will have a 2,000-ton daily capacity. Around the mill the small town of Allenby has sprung into existence.

The lands surveyed by me during the season lie generally along the creeks mentioned, and they are readily accessible by roads from Princeton following the creek-valleys. A Ford car was used in moving men and equipment from point to point, and proved indispensable, as horses were almost impossible to hire, the demand being far greater than the supply, a condition applying also this year in a degree to men. The valleys are all narrow, varying from a quarter to three-quarters of a mile wide. The pre-emptions concerned were seldom found to include more than a third of their area of bottom land, the greater part lying along the steep hillsides and benches bordering the creeks. The growth along the bottoms is usually dense, consisting of willow, alder, poplar, and birch, whilst the hillsides and benches are timbered with fir and yellow pine from 12 to 50 inches in diameter. The soil in the bottoms is a rich loam and on the hillsides and benches sandy and frequently very rocky.

Along Allison (One-mile) Creek a wagon-road extends from Princeton northward a distance of about twenty miles, still lacking about eight miles to connect up with the main road from Merritt passing through Aspen Grove. If completed, this route will shorten the distance between Merritt and Princeton by some sixteen miles, making the journey fifty-six as compared with

seventy-two miles over the present travelled route via Tulameen and Otter Valley. Several small but none the less picturesque lakes are encountered through this valley, around which the wagon-road winds, affording additional attraction to the traveller. There are five or six ranches along Allison Creek devoted to mixed farming, the tilling of the soil, the rearing of cattle, sheep, and poultry, and the making of butter. Good crops of hay, grain, and vegetables were seen.

The valley of Hayes Creek, better known as Five-mile Creek, is wider than that of Allison Creek, but lacks adjoining range lands. Here also is a moderately good wagon-road following the creek, but wanting a few miles of construction to link up with the road running westward from Summerland and the Okanagan Lake. Osprey Lake is the present limit of the road on the Princeton side.

The valley of Summers Creek is very similar to that of Allison Creek, to which it is tributary. A road extends as far north along it as Lot 3348, from whence a good pack-trail leads on a water-grade to Missezula Lake, a distance of eight miles.

The country generally covered in my surveying operations is mineralized. Exposures occur along the hillsides flanking the valleys, showing deposits of copper ores, and along Allison Creek, magnetite. Outcroppings of coal are to be seen along Summers Creek, being probably the northerly fringe of the Princeton coal-basin, extending southerly eleven or twelve miles to the foot-hills of Copper Mountain, and estimated to cover an area upwards of forty square miles. The coal is sub-bituminous. Only one company—the Princeton Coal and Land Company, Limited—is actively engaged in coal-mining in this basin. The coal is shipped to Vancouver, Vancouver Island, and many points in the Interior served by the Kettle Valley and Canadian Pacific Railways, as well as to a number of points in the neighbouring State of Washington. The output for the twelve months ending March 31st, 1918, was about 44,000 tons, of which about 14,000 tons were sent across the International Boundary.

The West Kootenay Power and Light Company, Limited, which derives its energy from Bonnington Falls, has under construction a power-transmission line to the mill of the Canada Copper Corporation at Allenby, to which allusion has previously been made, and it is understood that provision will be made for the supply of power for other industries within this district.

The local need is not so much the settler to clear and cultivate the land as capital in the hands of capable mining men taking advantage of the special facilities afforded to develop the mineral resources. A great deal of work has been done in prospecting by W. C. McDougall and his associates on the Regal Group, Allison Creek, and by Uhler and Cox on the Shamrock Group, Hayes Creek.

Our surveying operations took us to Red Creek, a tributary of Hayes Creek. This region of the country was thoroughly burned over by forest fires in the summer of 1914, in effect clearing a way for the prospector through the dense tangle of jack-pine, underbrush, and windfalls formerly covering this watershed. As a consequence several promising locations have since been made.

I have, etc.,
P. W. GREGORY, B.C.L.S.

LOWER MAINLAND COAST AND ISLAND, NEW WESTMINSTER, AND COAST DISTRICT, RANGE 1.

BY H. H. ROBERTS.

November 12th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report upon the surveys carried out by me in New Westminster District and Range 1, Coast District, during approximately two months of the past survey season:—

In organizing my party, your instructions that preference should be given returned soldiers over other applicants and that men should not be drawn from industries connected with the war were carried out. A gasolene-launch and a rowboat fitted with an Evinrude engine facilitated the work and added to the efficiency of the party. The work allotted to me consisted chiefly of

the survey of unsurveyed pre-emptions on Cortes and Redonda Islands; on the Mainland, work extended from the vicinity of Melanie Cove, Desolation Sound, northwards to Churchhouse, near the entrance to Bute Inlet.

Redonda Islands.

The islands, known as the East and West Redonda, are situate near the entrance to Toba Inlet, being separated from the Mainland by Pryce and Homfray Channels and Desolation Sound. Waddington Channel leads from Desolation Sound north-westward between the two islands. About three miles from the south-easterly entrance of Waddington Channel, Pendrell Sound branches off to the northward, extending six miles, with an average width of three-quarters of a mile, and nearly dividing Redonda Island into two parts.

The work at West Redonda Island consisted of the survey of one piece of vacant Crown land adjacent to surveys made by me in 1917 and fronting on Black Lake. Black Lake is situated in the south-east portion of the island and drains into Salt Lagoon, Waddington Channel. Lot No. 5015 was assigned to this parcel, which contains an area of 96 acres, of which about 10 acres are first-class land.

On the East Redonda the land rises to a great height, and the country is extremely rugged, making surveying operations difficult and in many places impossible.

Lots 5017 to 5020 are situated on the east side of the East Redonda, and all of them front on Homfray Channel, with the exception of Lot 5019, which is separated from this channel by Crown-granted Lot 3628. The areas of good land on these lots are limited. The settler on Lot 5018 possesses an exceptionally fine garden producing potatoes, carrots, turnips, cabbages, onions, cucumbers, and apples. The same settler has found hogs serviceable in clearing and preparing land for cultivation.

Mainland.

Of surveys on or near the Mainland, that of Eveleigh Island was the southernmost. This island lies at the entrance to Melanie Cove, which is situated in the north-east part of Desolation Sound. It is about three-quarters of a mile in length, with a maximum width of a quarter of a mile, and is separated from the Mainland by a narrow passage which dries at low tide. This island was recently logged, and at the time of survey the smoke from the burning of logging debris made it difficult to make accurate triangulation ties to surveys on the Mainland and Redonda Islands. Eveleigh Island is low-lying and for the most part rocky and broken, with scattered areas of land carrying a light soil. Practically all the timber of merchantable value has been logged off, the standing trees being chiefly scrub fir, cedar, and hemlock.

Homfray Channel is about fifteen miles long, being a continuation northward of Desolation Sound. My instructions called for the survey of six pre-emptions on that portion of the Mainland fronting on this channel. Only two of these pre-emptions were included in my work, the other claims being unoccupied, unimproved, and (excepting one parcel which carried more than the statutory amount of timber) not particularly suitable for settlement.

Lot 5016, fronting on Homfray Channel, is about three-quarters of a mile south of Lloyd Point, which is a point of call for steamers and has a post-office. This area was recorded in favour of a pre-emptor on military service who has made the supreme sacrifice. It contains little land of agricultural value, but carries a considerable amount of fallen cedar which will be suitable for shingle-bolts.

Lot 1834 is near Atwood Bay, in the northern end of Homfray Channel. This parcel contains 185 acres, of which 15 acres are classified as first-class land. The settler's improvements consist of a house and garden.

The Mainland in the vicinity of Homfray Channel was at one time covered with a good growth of fir, cedar, and hemlock, but a greater part of the timber has been logged or destroyed by fire. Large areas are now covered by a second growth of fir, hemlock, and alder.

Churchhouse.

Churchhouse is the name given to an Indian settlement on the Mainland near the northerly end of Calm Channel. This channel is nine miles long in a north-westerly direction, and lies north of Lewis and Sutil Channels, leading from them to Bute Inlet; its shores rise abruptly to a great height. At Churchhouse a pre-emption adjoining the Indian reserve was surveyed. The question as to the boundaries of this pre-emption has in the past been the cause of considerable friction between the settler and the Indians, but it is hoped that the adjustment of

the boundaries will prove satisfactory to all parties. Churchhouse has a good store and post-office and is furnished with a weekly boat service by the Union Steamship Company. The chief occupation of the Indians is fishing and hand-logging.

CORTES ISLAND.

Cortes Island is situated at the head of the Strait of Georgia, lying between Read Island and the Redonda Islands. The island is well settled and is traversed by several good roads and trails. The chief settlements are at Manson's Landing and Whaletown on the west side of the island, and in the vicinity of Seaford and Squirrel Cove on the easterly side. These points have stores and post-offices and are well served by boats of the Union Steamship Company. Section 12 and portion of Section 13, situated in the south-east portion of Cortes Island, were subdivided into seven parcels, varying in area from 80 to 160 acres and held under pre-emption records. With one exception, all the settlers are in active occupations, and their improvements consist mainly of houses, outbuildings, gardens, and clearing.

GENERAL REMARKS.

The vicinity of the season's work is about a fourteen hours' journey from Vancouver, and is supplied with a good boat service by the Union Steamship Company. Some of the settlers are engaged for a considerable portion of the year either in logging camps or at hand-logging; others, during the summer and fall, are occupied with fishing, the principal waters being Toba Inlet and Bute Inlet.

In the logging camps, summer resorts, Powell River, and Vancouver the settlers have good markets for everything that they can produce.

I have, etc.,

H. H. ROBERTS, B.C.L.S.

QUEEN CHARLOTTE SOUND, COAST DISTRICT, RANGE 1.

BY JNO. ELLIOTT.

November 18th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report on the work done during the past summer:—

This work consisted of a survey of the mainland shore of Queen Charlotte Sound and portions of contiguous waters from Shelter Bay to the mouth of Smith Sound, also of two pre-emptions on Branham Island and eight others on the shore of the sound east of Blunden Harbour.

Along such portions of this shore as are exposed to the open sound all vegetation has been destroyed within the limits of the area reached by the surf, and for some distance farther the trees are all stunted and distorted into most fantastic shapes by force of the winds, which at times must be very great. But where the shore is sheltered by adjacent islands and in the lagoons and inlets the forests come to the water's edge, and at high tide the lower branches sweep the water. About midway between Buccleugh and Rayner Points there is a striking exception to the above description; there, for about two miles and a half, lies a stretch of firm sandy beach which if close to some large centre of population would no doubt be of great value as a summer resort. Behind this beach lies a strip of low-lying level land covered with small scrubby timber, and which appears to connect by a low pass with the westerly end of Belize Inlet.

There are indications of coal in several places. A number of claims have been staked and in some cases surveyed, and some prospecting has been done, but with what success I do not know. I saw no traces of any other mineral.

Deer are plentiful all along the Coast, and during the migratory season great numbers of wild geese are to be found in any of the bays in which a large area of tide-flat occurs. Beavers must have been plentiful some years ago, and from signs found this year I believe that they are again slowly increasing in numbers.

There is a salmon-cannery in Nugent Sound, off Seymour Inlet, and a considerable number of hand-loggers scattered along the main inlet and its various tributary inlets, sounds, and lagoons, and these are so far the only industries in this district.

The nearest port of call for steamers is Hardy Bay, on Vancouver Island, communication with which is usually by gasolene-launch; and the possession of a good boat is, in fact, the first requisite of any one intending to do anything in this locality.

So far there has been no settlement along this shore on the Mainland, but on Branham Island, lying off the mouth of Seymour Inlet, several pre-emptions have been recorded, though very few of them have been occupied. This island is separated from the Mainland on the east by Schooner Pass, which in places is not over 250 feet wide, and on the north by Slingsby Channel, having a width of about half a mile; in both these channels the tidal current is very strong, attaining a velocity of over ten miles an hour in portions of Slingsby Channel, but on the south and west the island is exposed to the open sound.

In consequence of this, while the north-easterly part of the island carries the amount of timber normal to this region, the south-westerly portion is much more lightly wooded and contains considerable areas of open grassy land, usually very wet and nearly always broken by rock-outcroppings. If the wild grass could be supplanted by tame without having to do any extensive cultivation of the soil, it might be possible to do something with stock, but, failing this, I do not think that any other kind of farming would prove successful.

The pre-emptions surveyed east of Blunden Harbour are similar to adjacent lands surveyed and described last year, the only difference noted being the number of small lakes met with this year. These lakes, though they could be lowered somewhat by breaking the beaver-dams at the outlets, are so deep and their beds of such contour that such lowering would be of little benefit.

I have, etc.,

John Elliott, B.C.L.S.

RIVERS INLET, FITZHUGH SOUND, AND BURKE CHANNEL, COAST DISTRICT, RANGES 2 AND 3.

By C. C. Smith.

December 19th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—With reference to my surveys carried out for your Department during the past season, I have the honour to report as follows:—

My work consisted principally of tie traverses, shore traverse, and triangulations extending from the North Arm of Moses Inlet, through Rivers Inlet, Fitzhugh Sound, and Burke Channel to Labouchere Channel. My outfit consisted of one 40-foot launch, one Linton rowboat, one small rowboat, and a Peterborough canoe. An Evinrude motor was used in the large rowboat.

As was the case last year, the old surveys of the lots were very hard to find. For instance, all trace of the survey of Lot 2 at Koeye River has been obliterated, and the only evidence remaining of the position of the lot is the shape of the shore-line. In order to facilitate adjoining surveys it is very desirable that these lots should be resurveyed.

In traverse and triangulation the same methods were employed as I used last year. In the triangulation of Fitzhugh Sound some of the sides of the triangles were very long and targets were erected with four cross-heads, two being 1 foot x 6 inches and two being 1½ x 4 feet.

At the southerly end of this triangulation a base approximately three miles long was measured by stadia, and at the northerly end, at Restoration Bay, a base 65 chains long was chained as accurately as possible without using base-measuring apparatus.

Agricultural Possibilities.

Of the land bordering the shore from the head of Moses Inlet, around by Schooner Pass, up Fitzhugh Sound, and along Burke Channel to Labouchere Channel, there is none that a settler could improve and make a living on under present conditions. There are a few acres around the mouths of some of the creeks that would contribute to the support of a settler's home if he had other means of support. There are some areas of partly open meadows similar to the

pre-empted areas at Millbrook Cove and Takush, on which an experimental farm would appear to be a capital investment, as these will not grow timber and might by some method of treatment yet unknown be made capable of agricultural development.

Other Industries.

At present fishing and logging are the industries being carried on, and with proper conservation these industries can be made perpetual here. Approximately 800 people engage in fishing in these waters during the fishing season, which lasts about two months. One man alone made $1,800 that I know of, and some may have made more. An average would probably be $500. But unless some limit is put on the catch the industry is threatened with extinction. As yet salmon is the only fish caught, but there are herring, cod, and other species which will permit of the industry being carried out during a longer season.

The country is almost all heavily timbered with cedar, hemlock, balsam, and spruce. Excepting in the creek-valleys, the timber is of medium grade and is not large. So far only the large timber in the creek-bottoms has been logged, but the supply of this is limited, and the high-lead system of logging is leaving a great deal of waste. Before long the pulp-mills will have to use more cordwood, and this will give permanent work for a large number of small operators.

This part of the Coast is well stocked with game. Deer are plentiful, as also are black bear and goat. Marten, mink, fox, bear, and wolf are caught in fair quantity by the trappers.

On account of the many small bays and harbours these waters are splendid for small-boat transportation. In the late summer and fall, however, Burke Channel becomes very rough occasionally. North winds strike it suddenly and violently, and as the tide runs strongly the seas become very choppy. In Fitzhugh Sound, Safety Cove, Goldstream Harbour, and Namu are the main harbours, but many other bays are available for launches.

I have, etc.,
C. C. Smith, B.C.L.S.

CUMSHEWA INLET, QUEEN CHARLOTTE ISLANDS, AND ROSCOE INLET, COAST DISTRICT, RANGE 3.

By A. E. Wright.

December 10th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit the following report on the economic conditions in the area contiguous to my survey operations while triangulating in the vicinity of Cumshewa and Selwyn Inlets, Moresby Island, and in the vicinity of Roscoe Inlet near Ocean Falls.

Cumshewa Inlet.

This is an inlet about eighteen miles long and one mile and a half wide, separating Louise and Moresby Islands. Its shores are for the most part low and covered with a heavy growth of exceptionally fine spruce timber. The north or Moresby Island shore rises gradually to the Interior Plateau and has an elevation of from 300 to 800 feet. The interior between Cumshewa and Skidegate Inlet is heavily timbered, especially in the river-bottoms and on the shores of Skidegate and Mosquito Lakes. On the north or Moresby Island shore the rocks exposed are sedimentary in origin, consisting of sandstones and shales, with bands of impure limestone. Many interesting fossils are seen on the north shore of Cumshewa Inlet, and especially on Fossil Island.

The greater part of the south or Louise Island shore is granite intrusives and is much steeper, although also covered with a heavy growth of valuable timber.

The minerals so far discovered are contained in some twenty mineral claims on Louise Island, one mile and a half south of the abandoned Indian village of Clew, at an elevation of 1,100 feet. The ore is a high-grade magnetic iron and development consists of test-pits, stripping, etc.; the quality is excellent.

On the north shore, near Lot 172, half a mile from the beach, is a group of Crown-granted claims called the Homestake Group. The ore is gold, silver, lead, zinc. About 2,000 feet of tunnels, crosscuts, etc., have been driven; but the property has not been worked for several years.

Cumshewa Inlet, along with all points on Moresby Island, has weekly steamer connections with Prince Rupert, Victoria, and Vancouver. These steamers call at all the principal logging camps. There is as yet no settlement in the district.

The only land in the vicinity which is at all suitable for any form of agriculture has either been purchased already or is held as timber licences, and will not be available for settlement until the valuable timber is removed.

The nearest pre-emptions are on the shore of Gray Bay, on the east of Moresby Island, about six miles north of the entrance to Cumshewa Inlet. W. Rudge, who resides with his family at Copper Bay, a few miles north of Gray Bay, has several head of cattle, which graze along the shore almost the entire year. Farther north on Sandspit, at the entrance of Skidegate Inlet, are several prosperous farms which supply beef to the logging camps and canneries.

There are no wagon-roads or trails in the vicinity of Cumshewa Inlet, the nearest being a foot-trail between Copper and Gray Bays.

By far the principal industry is the logging of aeroplane spruce, which has attained large proportions during the last year through the fostering of the Imperial Munitions Board. Some eight or ten camps are established on Cumshewa Inlet alone, and the industry should continue to flourish, even though the spruce may not now be needed for war purposes. The spruce is towed to the Northern Mainland sawmills at Prince Rupert, Ocean Falls, and Swanson Bay in Davis rafts. It is there sawed and shipped over the Grand Trunk Pacific to the factories in Toronto and Great Britain. The spruce timber in this inlet is particularly adapted for the manufacture of aeroplanes, and so far 18,000,000 feet of Nos. 1 and 2 aeroplane spruce has been shipped from Cumshewa Inlet alone.

Large quantities of salmon, principally cohoes and humpbacks, are caught each year and canned by the cannery at Abford, in Skidegate Inlet.

Selwyn Inlet.

The head of Selwyn Inlet is connected with Cumshewa Inlet by a narrow neck of water called Louise Narrows, which is only navigable at high water by small boats. The shores of Louise Narrows are for the most part steep and heavily timbered, and several hand-loggers were operating there this summer.

At the head of Selwyn Inlet are two other inlets—namely, Sewell, bearing south-westerly, and Lagoon, north-westerly. These inlets are both heavily timbered and are now being logged. The head of Sewell Inlet is connected to the head of the North Arm of Tasu Harbour by a good trail about three miles and a half long.

About a mile from the head of Lagoon Inlet, Colonel MacMillan, of Vancouver, has built a salmon-cannery, which was completed in time to take a large part of the season's catch.

At Thurston Harbour, on Selwyn Inlet, the Imperial Munitions Board has erected all the apparatus necessary for the formation of Davis rafts, together with a wharf, wireless station, and a storehouse for the convenience of hand-loggers, and a hospital and houses, etc., for the workmen employed. The rafts from this vicinity are towed to the Northern Mainland, there sawed, and shipped to the Eastern aeroplane-factories. So far, 13,000,000 feet of Nos. 1 and 2 spruce, suitable for aeroplane-manufacture, have been logged from this vicinity.

The Imperial Munitions Board had practically completed the erection of three sawmills at Thurston Harbour to take care of the logs cut during the winter, as it is dangerous to attempt to tow rafts to the Mainland during the winter. I understand that these sawmills are now being dismantled, as the necessity for local sawing as a war measure is no longer there.

The climate of these parts of the Queen Charlotte Islands is not as wet as that of the Mainland in the same latitude, and some of the logging camps were threatened with having to close down on account of the lack of water in the latter part of July. There is little or no snowfall, except on the higher ground.

A small variety of black bear is the only game which can be said to be numerous. They frequent the creek-mouths and beach during the salmon run, and one was bold enough to scratch himself on the legs of a transit left out overnight, without upsetting it. There were a few varieties of ducks and some geese in the vicinity during the summer, but they do not come in great numbers until late in the autumn.

ROSCOE INLET.

Roscoe Inlet is connected with Fisher Channel by Johnson Channel, which commences about fifteen miles south-west of Ocean Falls. Johnson Channel is about eleven miles long and one mile wide, and Roscoe Inlet is twenty miles long and about one mile wide. The shores are rough and precipitous, and no trails or roads of any kind are in the area embraced in this report. A few pre-emptions are found near the lower end of Johnson Channel and on Gunboat Passage, but as one goes northward along Johnson Channel the country becomes too rough to be of any use for agriculture.

The shores of both Johnson Channel and the lower portion of Roscoe Inlet are covered by a growth of good cedar, spruce, and hemlock; and several hand-loggers and three logging camps were operating this summer, all the logs being sent to Ocean Falls. The greater part of the timber, is however, better suited for the manufacture of pulp. Some of the larger creek-bottoms contain some very good spruce.

There is very little land here which could be used as pre-emptions outside of those already mentioned, and these are too far from markets, post-office, etc. The post-offices at Bella Bella and Ocean Falls are about equidistant.

There is no mining activity on either Johnson Channel or Roscoe Inlet, and the general appearance of the country does not look inviting from a prospecting standpoint. Roscoe Inlet penetrates into the heart of the Coast Range, where the country-rock is a particularly hard white granite, which rises almost perpendicularly out of the inlet and is very rugged in appearance. There is practically no timber on this part of the inlet, except in the creek-bottoms.

Considerable salmon are caught during the summer at several points on the inlet and taken to the cannery at Namu.

Game in the form of deer and black bear are plentiful, the latter being particularly numerous on the creeks near the head of the inlet; and there are probably some grizzlies, although no tracks were seen. Goat are also found on the steep mountain-sides near the head of the inlet. Grouse, geese, and several kinds of ducks were seen in the summer, and should be much more numerous later on in the fall.

The climate is typical of the Central Coast, being usually pretty wet, although this summer, along with all the rest of the Coast, it was quite dry. The snowfall is very heavy and usually stays until the end of March or beginning of April.

I have, etc.,

A. E. WRIGHT, B.C.L.S.

MISCELLANEOUS SURVEYS, WEST COAST, VANCOUVER ISLAND, AND LOWER MAINLAND COAST.

BY L. S. COKELY.

November 5th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—During the past season I was engaged on miscellaneous surveys on Vancouver Island and on the Coast of the Mainland, the first two months and a half being spent on the west coast of Vancouver Island.

The various districts of the west coast of the island are much the same, there being little arable land in proportion to the entire area. Much of the country is mountainous and very rough and broken, of little value, except for the timber and what minerals may exist. The timber varies in quality, and while large tracts of good fir exist, most of the timber is hemlock, cedar, and spruce. Throughout a very dense undergrowth of salal pervades the timber, and near the shore this is almost impenetrable.

The climate is mild, with little snow near the sea. The rainfall varies from 80 to 120 inches. During the clear summer weather dense fogs drift in from the ocean and leave the timber as wet as a heavy rain would.

The mineral resources are largely unknown, as very little prospecting has been done; the nature of the country and the heavy timber render it slow and expensive to prospect. There would appear to be copper in abundance, and several mines are shipping ore, the largest being the group on the South-east Arm of Quatsino Sound.

The country is sparsely settled, and what settlement there is is near the Coast in the vicinity of the various industries. Owing to the mountainous character of the country there are very few roads or trails, and most of the travel is by water. There are many good inlets and sounds which afford protection from the rigors of the open Pacific, and it is along the shores of these that the canneries and sawmills, which are the chief industries, are located. The Canadian Pacific steamer "Princess Maquinna" makes three trips a month up the Coast, calling at all the ports.

Game is not plentiful; there are very few deer and a few black bear and panther. There are no grizzly bear on the island.

My first camp was near Port Renfrew, on the Strait of Juan de Fuca. We found the country here similar to other parts of the Coast; the timber is rather small, consisting of spruce, cedar, and hemlock, with a dense undergrowth of salal. The surface is broken with many small ridges and ravines, and the soil is very poor, being mostly rock. The nature of the surface and the dense growth of salal made surveying operations very slow and tedious. There were very few settlers in the part in which I was engaged, there being a small settlement at Port Renfrew, where a salmon cannery, opened this year, is the chief industry.

Our next move was to Pachena Bay, just south of Barkley Sound. Here we were on the open Pacific, and we had a very rough trip around Cape Beale from Bamfield in a launch. The water is shallow and the seas break heavily in the bay, which affords no shelter for boats. The country is heavily timbered, with hemlock predominating, and with the ever-present undergrowth of salal. Some good land lies along the shore of the bay, and not far inland is an open muskeg flat of about 150 acres which was taken up and Crown-granted years ago, but no use is being made of it. A little farther west toward Cape Beale is Trout Lake, around which was a small settlement a few years ago, but which is entirely deserted now. The soil here is very poor and the country rough and broken. In the vicinity of Pachena Bay are a few settlers, the majority of whom are Russians, none of them having extensive improvements. Four miles from Pachena Bay and connected by wagon-road is Bamfield, the terminus of the Pacific cable. The Pacific Cable Board has a well-equipped office building employing a large staff. There is quite a village here of the employees and their families. Bamfield is easily accessible, as a launch runs three times a week from Port Alberni, and the C.P.R. steamer calls three times a month.

From Pachena Bay we took a launch across Barkley Sound to Mayne Bay. We found the water too rough and had to camp on an island in the sound until the sea calmed. At Mayne Bay we were very isolated and did not see a soul all the time we were camped there, there being no settlers. Most of the land is held under timber licences and there is little arable land. About five miles from Mayne Bay is Sechart, where a whaling-station is located, but it was not in operation this season.

After completing the work on the west coast I returned to Victoria about the first of September and paid off my party.

My next work was more in the nature of an inspection survey, and I took only one man with me. This arrangement had its advantages and disadvantages, as in our first camp on Jervis Inlet, between Vancouver and Powell River, we were visited during our absence by a drove of beach-combing pigs which just about cleaned us out. As a result we spent several weary hours in building a log fence around our tent. The chief industry here is logging, and much of the country is heavily timbered with fir of good quality. We also noted several good farms that had a look of prosperity.

From Jervis Inlet we moved to Powell Lake. Here we were engaged in making a triangulation survey of parts of the lake and a complete triangulation of Goat Lake. In this work we were seriously hampered by the smoky state of the atmosphere, due, no doubt, to the heavy forest fires that raged in the vicinity during the summer.

The country around the lakes is very mountainous; we measured one peak which came right to the edge of Goat Lake and found it to be 6,000 feet high. There is very little arable land and logging is the principal industry. There are two logging camps on Goat Lake and two sawmills on Powell Lake.

Powell Lake is drained by Powell River, a stream about half a mile long, which was dammed by the Powell River Company to such a height that the water was raised in the lake about 15 feet. When it is considered that the lake is about thirty miles long it will be seen what a vast storage-reservoir the company has. The lake is quite a pleasure resort for the people of Powell River, and many house-boats and launches are to be seen on the water.

The townsite of Powell River is the property of the Paper Company and is well laid out and beautifully kept. The houses are all well painted and the streets are laid out with ornamental shade-trees. The people are prosperous, as the plant pays good wages. The paper-mill itself is a large concern, turning out 250 tons of newsprint a day. It supplies paper to nearly every daily paper on the Coast, including the American cities. They have well-equipped buildings and a very good dock. Naturally most of the working-people are employed in the paper-mill, but there are a few other sawmills and shingle-mills which employ a portion of the residents.

From Powell Lake we went to Denman Island, and were engaged on the subdivision of the reserve on the southern portion of the island. We also surveyed a few small islands near by for the Dominion Government. Denman Island has been settled for many years and the inhabitants are prosperous. There are many good farms and the island is very well suited for raising sheep, as there are no panther present. About half-way up the island is a Government wharf, and a store, post-office, and church are near by. The C.P.R. furnishes a semi-weekly boat service direct from Vancouver and Nanaimo.

The last two months we used an 18-foot boat and an Evinrude engine, which we found to be satisfactory, except the last two weeks, when the weather was too rough to be able to depend on using the boat when needed.

I have, etc.,
LEROY S. COKELY, B.C.L.S.

LANDS FOR RETURNED SOLDIER SETTLEMENT NEAR FORT ST. JAMES, STUART LAKE, RANGE 5, COAST DISTRICT.

BY J. H. GRAY.

January 14th, 1919.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit herewith general report upon the survey operations carried out last season in the Stuart Lake District jointly by D. J. McGugan, B.C.L.S., and myself. The tract subdivided and examined in detail consists in all of 61,359 acres situated upon either side of Stuart River, directly south and east of Fort St. James, at east end of Stuart Lake.

This entire area, on account of location and physical variety has been divided into three groups—viz., A, B, and C—to which reference shall be made.

Group A.—This group comprises forty-six originally surveyed lots or parcels of land, aggregating 22,917 acres, situated on the west or right bank of the Stuart River, directly south of Stuart Lake, having a river-frontage of nearly ten miles, with a general depth, southerly, of five miles.

Group B.—Group B comprises fifty-two original lots, aggregating 28,539 acres, occupying an area some seven miles square, north and east of Fort St. James, at the east end of Stuart Lake.

Group C.—Group C includes fifteen original lots, containing 9,220 acres, lying to the south-east of Fort St. James, in the valley of Necoslie River, which flows north-westerly into Stuart River, where the latter leaves that lake.

GROUP A.

Comparison with other Groups.—Group A (22,917 acres) of the land so far subdivided includes more generally and to a greater extent than the other two groups areas possessing the requisite and attractive conditions inviting to settlement—viz., the best of soil, light clearing,

with a percentage of open land, regular surface, and, with the exceptions noted, good water-supply; moreover, a fairly good wagon-road connection already established with railway communication.

Classification.—The total, 22,917 acres, contained on Group A has been divided as follows:—

	Acres.
First-class land	19,377
Second-class land	2,080
Third-class land	960
Muskeg land	500

The land on the area specified "first-class" consists of a light and dark chocolate-coloured loam, extremely consistent as to grade, irrespective of tree-growth, throughout the whole tract.

First-class Lands, 19,377 Acres.—This soil is very fine in texture, thereby containing capillary moisture to a maximum extent. In August last it was necessary to only kick up an inch or so of soil to find dampness.

It would appear that the soil deepens in colour and possibly becomes more "clayey" upon the Stuart bank, but at no point were found churnings or lumps, resulting from vehicular traffic that might not be easily pulverized in one hand.

This land is entirely free from stones or rock, and excepting the steep sides of the trough of Todd Creek, about 60 feet deep, and a few lateral gullies, there is nothing to prevent, but the standing timber, the whole area from being ploughed.

The overlying leaf-mould or humus varies from 2 inches to ½ inch in depth, dependent upon tree-growth. Poplar creates the greatest thickness, decreasing to but a thin covering where solely evergreen timber prevails. In the same way the natural covering of wild grasses, vetches, and berry-bushes, for the most part luxuriant amongst poplar, diminishes in extent in proportion to the greater or sole evergreen growth, but, as before stated, the excellent character of the land or soil remains unchanged.

Second-class Land, 2,080 Acres.—Under the heading of "Second-class Land" is soil generally a lighter quality of loam, intermixed with a varying percentage of gravel and boulders, the latter on the higher elevations or tops of local ridges. These areas, although cultivable, would not at the present time be sought, nor attract attention, except as possible cattle-runs, whenever the more attractive areas become "fenced in."

This indifferent land is found on the westerly boundary of group, from Lot 1646 south to Lot 1605.

Third-class Land.—The third-class area (960 acres) may be eliminated entirely from any sphere of utility, beyond a possible supply of building-timber. Otherwise this is an area of useless land, occupying practically the whole of Lot 1648 and centre of Lot 1649.

Merchantable timber comprising fir, spruce, and pine is found here; the whole aggregating a supply of some 7,000,000 feet, which, although possibly a useful adjunct to near-by settlement, could not compare with other sources of similar supply, approximate generally to the settlement area.

Muskegs are scattered.—An area of 500 acres of this class of land is to be found in Group A, about 70 per cent. of which is open. Pending more data as to the feasibility and cost of drainage, these have been classed as "lost lands" at the present time.

Unlike other classifications, muskeg is by no means isolated, but occurs at various intervals ranging in extent from 2 to 40 acres. Their position and extent in relation to each quarter-section may be learned from the detail reports.

Clearing, Group A—First-class Land, $21 per Acre (Average Cost).

The following remarks in respect to clearing relates to the area of first-class land only, some 19,377 acres.

An attempt has been made to estimate the cost of preparing the surface for rough-ploughing in the various degrees of tree-growth. This cost ranges from the minimum in open poplar through changing percentages of this timber with spruce and pine and willow, to a maximum in sole evergreen growth.

Useful Timber eliminated.—In the figures of estimated clearing cost of the first-class land area there has been eliminated some groves of "building" spruce and pine, having a diameter of from 12 to 14 inches and aggregating about 500 acres in extent.

This has been done in the belief that the value of such timber is greater than the cost of removal, which removal under ordinary circumstances would be brought about only by degrees, as requisitioned for useful purposes. The enclosure of this class of timber under the head of ordinary clearing, where the material to be removed is valueless except possibly for fencing, would tend to mislead.

Clearing Cost under $21 per Acre.—It has been adjudged that with this elimination the maximum cost of ordinary clearing would not exceed $30 per acre, nor again cost less than $10, and hence is estimated the following:—

1,000	acres	costing	$30 00
6,641	acres	costing	25 00
6,368	acres	costing	20 00
4,151	acres	costing	15 00
717	acres	costing	10 00
18,887	acres	averaging	$20 81 per ac.

Relating to the above figures, I beg to repeat here what was written in my sub-report of August 18th last:—

"Before concluding, a word on the subject of clearing cost. In body of report are quoted figures of cost in relation to various localities.

"I recognize the risk in stating a price, especially in the absence of any practical experience. It might be explained, however, that what has been quoted is an endeavour to obtain an average rate over the whole parcel dealt with, unless otherwise specified. This would greatly vary in accordance with the manner in which the work was executed. I have tried to base my estimate of cost upon operations as usually followed by the ordinary settler—viz., of cleaning up the open and easier patches of land at his disposal and permit time to work upon his heavier woods (supposedly already slashed or killed).

"Should it be determined to clean up, say 50 square acres forthwith, the cost would certainly exceed my figures. Again, if 'straight-ahead' clearing were to be organized and prosecuted upon a community and large scale, I am of the opinion that they would be largely reduced."

There shall be found many quarter-sections in which, by following the stretches of more or less expansive open land or light tree-growth, it would be possible to clean up acreage under the minimum cost stated, and in many cases practically without.

Natural Water-supply.

Owing to the low altitude of the flanking ridge on the south (the watershed between this and the Nechako Valley), streams are infrequent, the water-supply here being confined practically to Todd Creek, which, after receiving Rabbit Creek, its principal feeder, some two miles within the tract, flows northerly, parallel to the Stuart River, *but in the opposite direction*, in a trough some 60 feet deep.

Numerous small lakes or ponds are scattered about; these, however, could not be counted upon to contribute potable water-supply during the summer months.

The Stuart River bounds the tract on the east, providing a bountiful water-supply of excellent quality (although not always convenient) to the areas adjacent.

Percentage of Dry Quarter-sections.

The distribution of the natural water-supply, as is usually the case, is inadequate to meet the general demands of the entire settlement area.

The first-class land as at present subdivided is composed of quarter-sections or parcels of land to the number of 128. Of this number, seventy-two are without a natural supply of good water, or about 56 per cent., while on fifty-six subdivisions, or 44 per cent., a good water-supply was found.

Wells.

What difficulties may be encountered in the sinking of wells is not known, since, owing to the absence of any settlement on this the west side of Stuart River, no undertaking of this description has been attempted. On the east or Fort St. James side wells have been sunk and water found at varying depths, from 20 to 40 feet.

An amelioration of this situation could, of course, be effected by varying the subdivision so as to distribute the existing supply to the greatest extent possible, since where found, principally Stuart River and Todd Creek, this essential is good and abundant. The lakes and ponds referred to would answer for stock.

Transportation, Group A—30 Miles from Railway.

The Government wagon-road from the Grand Trunk Pacific Railway at Vanderhoof to Fort St. James traverses the length of Group A, being practically twenty-five and thirty-five miles respectively from the former place and railway at its south and northerly boundaries. This road is used by automobiles in the summer and is a fairly good means of communication, subject to the usual disabilities attending country roads during change in seasons. Connection with the railway could be much reduced and still pass through a good line of country at its southerly end.

The crossing of the Stuart River to Fort St. James is at the present time by cable-ferry. A bridge just below the present ferry-site would be a simple affair.

Settlement should be inaugurated in Group A.

Group A, just described, constitutes the most favourable field in which to start settlement. The place within it at which a community point or headquarters should be established is on the present wagon-road at the point on west boundary of Lot 1551, where a bend in Todd Creek crosses and recrosses that line. This combines good water-supply with established line of communication, besides being approximate to several sleigh-roads and trails which traverse this tract in various directions. It is central and some of the most attractive subdivisions in the group surround it.

Cattle and Winter Feed.—Since a small herd of cattle shall be an essential adjunct to the settlers' undertaking, the question of available winter feed, in the beginning at least, is of first importance. Wild hay meadows of any extent in Group A are held under Indian reserve, excepting that in Lot 1656, which lot is already Crown-granted.

The lack of hay meadows here could be effectually met by utilizing temporarily, upon a community basis, the areas of this description in Group B; also the acquisition of Lots 1654 and 1656 may be considered advisable on general grounds.

Lumber—Local Price $35 per 1,000 Feet B.M.

Mill now operating.—A small mill is now established on the north shore of Stuart Lake, about six miles from Fort St. James. This turns out much more material than present needs require, and possibly there may be found cured lumber in stock. The present rate is $35 per 1,000 feet B.M.

Mill-site.—Should it be determined to augment this institution, there is a convenient and reverted Timber Limit 638P, Lot 4932, three miles from river-mouth on north shore of Stuart Lake, which would be available for a mill-site if water and a sheltered nook exists in which to place the plant. This shelter is requisite since this shore of the lake is exposed and shallow.

Stuart Lake Main Timber-supply.

Access to Stuart Lake.—The main timber-supply for not only Group A, but the entire settlement area as proposed, shall come from Stuart Lake, and there is no finer timber in the north than found on its shores. It would therefore seem desirable that access to the lake from within Group A should be secured.

Mouth of Stuart River Best Shelter.—Attention is directed to the alienated area lying to the north and east of Lot 1665, whereby this access would be effected, and what perhaps is of more importance, control over the sheltered waters within the mouth of Stuart River. This question, however, requires more research and expert decision.

Group B, 28,539 Acres.

This group occupies a shallow valley stretching north-easterly from the south end of Stuart Lake for a long distance.

General Description.—The area subdivided includes not only all the good land which lies in a strip some eight miles in length, averaging three miles wide, but extends north and south from this strip up the slopes of the flanking ridges in second- and third-class areas.

Tree-growth.—Evergreen growth in spruce and pine is in greater percentage and heavier than in the lands hitherto described, resulting in greater clearing cost. Open or hay meadows are found to a greater extent, as are also *drainable* muskegs. The general altitude is also greater than in Group A.

Group B suitable for Stock-raising.—In a general way Group B is better adapted for stock-raising than any other of the lands reserved, and beyond the few choice locations in the neighbourhood of Stuart Lake it is likely to be sought for this purpose, combined with a minimum of mixed farming. The whole district lends itself to the production of fine stock, in which, besides the luxuriant natural feed, the presence of a maximum of lime in the water may have something to do.

It is a good horse country, in many instances these run out all winter, but this is not advantageous treatment. A safe estimate would be three and a half months feed for horses and five months for horned stock.

The limited experience so far as practised seems to demonstrate the breeding of local animals with imported bulls to be more successful than the importation of unacclimated beasts —the same with horses.

Classification.—The 28,539 acres contained in Group B have been divided as follows:—

	Acres.
First-class land	13,465
Second-class land	11,752
Third-class land	1,940
Muskeg land	1,382

First-class Land, 13,465 Acres.—The first-class or really good areas of Group B are composed of the same chocolate-coloured silt met with in Group A. There is by no means, however, the same depth of this soil, nor its widespread and consistent excellence. These remarks would not occur only in comparison with such an exceptionally good tract of land as is found in Group A.

In the matter of open land or hay meadows and water-distribution it is better served than either of the other two groups, while the eight sections nearest to Fort St. James offer to immediate settlement inducements quite as attractive.

Hay Meadows.—In the acreage stated for first-class land is included 400 acres of what may be termed wild hay meadow, from a proportion of which hay is now being taken.

It is to this area reference was made in speaking of "winter feed" for settlers in Group A. Where it occurs the covering growth is willow, the removal of which is not costly, so that preparation for even only the wild grasses and their (meadow's) enlargement would guarantee the economical wintering of so much more stock.

Second-class Land, 11,752 Acres.—Second-class land, 11,752 acres, of same character as already described, occurs as the slopes of the adjacent ridges lying north and south are ascended. Owing to the large percentage of evergreen growth, summer feed in places is scant, but at least one-half of this area would be excellent cattle-run.

Third-class Land, 1,940 Acres.—Third-class land, 1,940 acres. This area consists for the most part of rocky tops of the flanking hills, and beyond the (in many cases) good growth of milling-timber are of no value.

Muskeg, 1,382 Acres.—This area is practically contained in one locality, known as the "Grand Muskeg," occupying portions of Lots 4752-4751 and 4725, on the imperceptible height of land between the waters flowing westerly into the east end of Stuart Lake and those into Ocock River on the east, the waters of which, after first flowing into Pinchi Lake, also reach Stuart Lake farther to the north and west. This muskeg is considered "drainable" at reasonable cost, but estimating this cost would require such examination as has not been given.

Lime.—It might here be remarked that, relative to the reclamation and "sweetening" of any such land, the district abounds in limestone, from which an excellent article of lime has been produced, and should be economically procurable.

CLEARING, GROUP B—FIRST-CLASS LAND, $25 PER ACRE.

The clearing cost relates only to the area included under head of first-class lands—viz., 13,465 acres. This has been determined at the average rate of $25 per acre.

Areas near Fort St. James.—The area referred to as "nearest Fort St. James offering inducement to immediate settlement" might be placed somewhat lower, since quite open land is to be found at intervals.

Clearing Second-class Land.—Clearing second-class land is placed at $30 to $35 per acre, and would include a large percentage of good building spruce and pine.

Natural Water-supply, Group B.

A glance at the map indicates that many small streams, all providing a perennial supply of excellent water, flow down from the northerly ridge and meander through the length of the better lands.

Subdivision.—The first-class area, 13,465 acres, consists of eighty-seven quarter-sections or parcels of land.

Percentage of Wet and Dry Parcels.—Of these, fifty-one, or practically 60 per cent., have access to a natural water-supply, while thirty-six or 40 per cent., are without water.

Lakes.—The two lakes that occur in Group B both contain good water.

Wells.—No wells have been sunk in this locality; it is, however, thought that no difficulty will be found in getting water at reasonable depth.

Transportation—Principally Hay-roads.

As stated, a Government wagon-road connects Fort St. James with the Grand Trunk Pacific Railway at Vanderhoof, a distance of about thirty-eight miles. This same road extends another mile to the Roman Catholic Mission on Stuart Lake. From the "Mission" the Manson Creek (Government) Road is roughly constructed and runs northerly to the northern boundary of tract.

Another road (the old McLeod Lake Trail) starts at Fort St. James and traverses the southerly tier of good sections to the east boundary, and a branch road from this crosses north-easterly and traverses easterly to the same boundary the northerly tier of good lands, so that Group B is already fairly well equipped with lines of communication, such as they are.

These roads have been constructed partly by settlers and to a large degree by the Indians, their principal use being for haying operations (teams and wagons) in the late summer and hauling of hay from the stacks in the winter months, for both of which duties they answer fairly well; during change in seasons, however, they are impassable for wagons.

Group C, 9,220 Acres.

That portion of Group C which was subdivided this season consists of a small portion at its north end of the reserved area lying in the valley of Necoslie Creek, and which may be said to be the inferior portion of this large and excellent tract of land. This inferiority relates particularly to those parcels lying on the southern slopes of the dividing ridge between this and Group B and to the north of the strip of pre-empted lands. It is in this locality that the second-class land noted below occurs. To the south of the pre-empted areas are excellent lands, quite ready for immediate *further* settlement.

A report will follow, made upon the subject of pre-emption improvements in this locality, in which it will be shown that these have been carried on to a considerable extent.

Classification.—Group C has been divided into two classes only, first- and second-class lands, viz.:—

	Acres.
First-class land	7,140
Second-class land	2,680

First-class Land.—The first-class land is of same composition as in Group A, and similar conditions as to depth and consistent grade prevail; generally speaking, however, the clearing is somewhat heavier.

Necoslie Water-flow.—The Necoslie River is a stream of dimension in flood, being from 75 to 100 feet wide and probably reaching a depth of 3 feet, which conditions are changed, however, in autumn to a small run of water forming pools between shallow ripples; abundant water, however, for all needs.

Necoslie Trough.—The stream itself is tortuous, winding across the intervening flats from foot to foot. These flats are open to a large extent, or except where covered with a light growth of poplar and willow. These locations offer opportunities for a small start with little preparation.

The foregoing remarks relate to the first ten miles of the stream, practically to the point where it traverses the north-east corner of the "allotted areas," beyond or to the south of which, through the reserved lands, the river flows closer to the surface of the adjacent ground.

Second-class Land, 2,680 Acres.—As stated, the second-class land, 2,680 acres, occupies almost entirely the northerly end of Group C, and not more than 60 per cent. of this area could be counted of much use for grazing purposes. The fine growth of timber found here, however, will be valuable.

Meadows and Muskegs.—The extent of this class of lands is negligible; that is to say, no extent of either is found in one place.

Clearing, Group C—First-class Land, $24 per Acre.

The tree-growth over Group C may be termed patchy, in so far that, although the mixed timber—poplar, spruce, and pine—prevails, all three are found in distinctly separate and unified groves, but, as in Group A, without change in the supporting soil. The cost of clearing the first-class land, 7,140 acres, has been estimated at $24 per acre, and this rate may be considered on the high side.

Natural Water-supply, Group C.

Outside the Necoslie itself the water-supply is poor. Group C as subdivided consists of forty-five subdivisions, of which twenty-seven, or 60 per cent., are supplied with water, while on eighteen, or 40 per cent., no water was found.

Transportation, Group C—Poor.

An ill-made or simply "swamped-out" road over which teams may be taken in summer extends through the length of the pre-empted lands as shown. This road starts at Fort St. James and dwindles into a trail ten miles out.

Climate.

Judging from the experience of people who have lived in this locality, the climate is healthful and invigorating. The summers are not excessively hot and showers are frequent up to the middle of August; the autumn is usually dry. Extreme winters last five months; sometimes only four, November to March. Low thermometer is never accompanied with wind. Blizzards, as also floods and droughts, are unknown.

Very cold snaps (—30° to —40°) occur each winter; these vary, but are usually of short duration, or three days. The average winter thermometer is around zero.

Precipitation.—The Dominion Meteorological Department has a station at Fort St. James under the direction of Mr. O. W. Murrey. From this source the average rain and snow fall for the past twenty years has been determined as 15.35 water-inches per annum.

Elevation—Stuart Lake, 2,200 Feet above Sea.

The elevations relative to each other and to Stuart Lake were determined throughout the three groups. Obtaining this information was incorporated with other survey-work, so that contours could be available for a topographical plan. These results have not yet been deduced, but it may be stated that, taking Stuart Lake to be 2,200 feet above the sea-level, the first-class land will be found to lie approximately as follows:—

Group A	2,200 to 2,430 feet above sea-level.
Group B.	2,250 to 2,500 feet above sea-level.
Group C	2,175 to 2,300 feet above sea-level.

Work of Survey.

It is not proposed to more than touch upon this subject at the present time, since the data obtained has not been fully made up, but to delay that report until such time as full returns shall have been completed.

Employees.—Two surveying parties were engaged; two surveyors and one assistant with eight returned soldiers and a cook left from Victoria in July last. This force was augmented on the ground, as the purposes of the work demanded, by engaging Indians and later another returned man.

Standard of Old Surveying-work.—The standard of the previous surveying applied to the original sectional subdivision was found to be excellent. The limit of error established for the subdivision survey having in no case been approached—in fact, excepting in the case of a few intersections, the joining error or difference, both in the cross-chaining and distance off old post, was negligible. The markings on old posts were scrutinized. In one case only was a correction made.

A detail report upon this and other matters pertaining to and resulting from the conduct of the work will be submitted.

SOIL SAMPLES.

Some twenty-four samples of soil were obtained from different points over the three groups. These samples were boxed to be forwarded the week after my departure from Fort St. James, but this has not been done. Word was received some ten days ago that they had been traced and were on their way. These with diagrams will be submitted whenever received.

TOTAL LANDS RESERVED, ONE-HALF SUBDIVIDED.

Area of Reserved Lands not subdivided.—The area subdivided is about one-half that covered by the instructions, which governed the work last season. The remaining area contains all the lands on east side of Stuart River, back to and across the Necoslie River, practically to its head. Speaking from a knowledge of this tract, it may be said it will be found to compare favourably, for the most part, with Group A.

In this connection it might be remarked at the present time that in the matter of transportation it should not be overlooked that the Stuart River offers an excellent and alternative line of communication direct with the Grand Trunk Pacific Railway, not only passing through these unsubdivided areas to the south-east, but as a probably more economical means of handling freight in the summer months to Groups A, B, and C.

Distance by Stuart River to G.T.P. Rly.—The distance by river from the present Stuart River ferry to the railway is sixty-seven miles, forty-two of which is good water. The lower river is swift, one rapid, and has been improved for navigation by the Dominion Government. There is no impediment that boats up to 25 tons, properly equipped, could not successfully and regularly negotiate during six months in the year.

Cross-road from Lot 2785 to Railway.—An excellent "cross-country" line for wagon-road connection with the railway (G.T.P.) exists from a point on west bank of Stuart River in Lots 2785 or 2786. Such a road would reach the railway at Vanderhoof in thirteen or fourteen miles, and strike the lower reserved lands at a half-way point on Stuart River, with an excellent slow-flowing stream on either side (up and down river), besides tapping to the east a natural ascending grade to the back lands.

EXPERT REPORT ON STUART RIVER VALLEY.

The following synopsis, in part, of a report based upon screenings and analyses of soil samples, made a few years ago by a land expert, Mr. Woods, as emphasizing the merits of this tract of country as a favourable field for settlement, may be interesting. He says in his report:—

"*Area.*—102,000 acres.

"*Location.*—In Central British Columbia, near the Grand Trunk Pacific Railway, at the foot of Stuart Lake and along the Stuart River for about forty miles.

"*Stuart Lake Basin.*—An old glacial lake, probably 200 miles long, with numerous arms and variable width—probably 100 to 200 feet deeper than the present lake and containing numerous islands which are now hills.

"*Now partly drained* down to the present lake, the 'pot-holes' of the old glacial lake.

"*The Silt Area.*—All the space between the present lake-rim and the old basin-rim.

"*The Lake-bed Soils.*—The humus: 1 to 3 inches of black vegetable mould.

"The 'white silt': 1 to 3 inches of volcanic dust.

"The 'chocolate loam': 4 to 12 feet of volcanic dust, formed as lake sediment in successive layers from 2 to 12 inches thick, with marine grass-roots and a large content of organic matter in each layer.

"The 'deep silt': A great deposit of fine volcanic dust underlying the chocolate loam to an unknown depth, but observed in the cut-banks of the river to a depth of 60 and 80 feet.

"'The finer the richer': The rule for all soils. (Fletcher on 'Soils,' page 25.)

"Silt and clay particles: These constitute the richness and durability of all soils.

"*Percentages of Silt and Clay in Different Soils.*—(8,671 samples analysed by United States Department of Agriculture from United States soils.) Of the many given, three highest are quoted:—

	Per Cent.
Clay soils	78
Silt loams	80
Silty clay loams	86

"*Stuart Lake Soils analysed—*

Stuart Lake and River 'white silt'	86.3
Stuart Lake and River 'chocolate loam'	86.8

"They are easy to work, are mellow when ploughed, and can be ploughed at any time.

"*Organic Matter in Various Soils.*—Of the many percentages given in Mr. Woods's report, a few of the higher and the highest are quoted here:—

	Per Cent.
Average soils, the average of many	2.30
North-eastern States (highest for average soils)	3.73
Average for rich silt soils	5.30
Yasoo bottom silt (Miss.)	7.37
Putah Valley dark loam (Cal.)	7.12
Arroyo Grande Valley dark loam (Cal.)	6.23

"The Yasoo bottom and the Arroyo Grande soils, mentioned above, are considered to be among the 'richest known soils.'

"*Organic Matter in Stuart Lake and River Soils—*

	Per Cent.
Stuart Lake and River 'white silt'	6.59
Stuart Lake and River 'chocolate loam'	6.72

"NOTE.—All of the above samples for organic matter undoubtedly include a portion of the top humus soil, except the samples of the Stuart Lake and River soils, which do not include any of the humus."

Speaking at length in respect to plant-foods and nitrogen especially, the report sums up:—

"With a top humus and over 6 per cent. of organic matter in its main soil and subsoil bodies, the Stuart Lake and River sediments are sure of surplus nitrogen-supply for an indefinite period."

On the question of moisture Mr. Woods has to say:—

"When at any time the amount of rainfall entering a soil becomes greater than the water-holding capacity of the soil, losses by percolation will result. The bad effects of excessive percolation are twofold: (1) The actual loss of water; and (2) the leaching-out of salts that may function as plant-food. The quantity of nutrient elements lost annually from the average soil in a humid region more than equals that withdrawn by the crops.

"*Unsurpassed Qualities of the Stuart Lake and River Sediment Soils.*—First: The finest texture couples with easy tillage.

"Second: A large excess in mineral plant-foods, as shown by all the analyses of silt soils.

"Third: An organic content in excess of the richest silt soils and far in excess of average soils. No other soils known to the writer or mentioned in the many soil authorities consulted so fully combines *richness, durability, and mellowness for easy working* and for the *conservation of moisture.*

"This could only occur, as in this case, where a wind-carried volcanic dust has been deposited in water and remained undisturbed under water until it accumulated a large organic content. Water-carried soils (alluvial soils) cannot preserve all of these qualities.

"In a word, these lake-bed sediments take the highest rank for fineness and durability, for ease of working, and for range of crop and capacity.

"*Conservation of Moisture and Soil Strength.*—The smallness of the rainfall at Stuart Lake and River (15.35 inches) is more apparent than real. The snow melts in March and April, about 13 inches enter the ground from March 1st to September 1st, during the period of growth and maturity, *and it is all utilized.* There is practically no 'run-off' and no sinking beyond the reach

of crops. The soil is porous enough to let it soak in, but fine enough to hold it by capillary force, without its sinking away as in sandy soils. Further, there is no leaching or flooding away of plant-food elements. Heavy rainfall hinders agriculture and wears out the soil by washing out its values.

"'Enough but not much' describes the Stuart Lake and River precipitation.

"In 'Soils,' by Lyon Fippin & Buckman, page 271, it is stated that of a 28-inch rainfall, one-half runs off, one-fourth evaporates, and one-fourth is used by the crop.

"*Clearing Land.*—Timber of fence-pole size; slashing and burning (by hand), $5 to $12 per acre; grubbing, $5 to $10 per acre. Eighty per cent. of the land could be cleared, grubbed, and ploughed in a single operation by a simple machine of proper size at less than $5 per acre."

I have, etc.,

J. H. Gray, M.E.I.C., B.C.L.S.

PHOTO-TOPOGRAPHICAL SURVEY, OKANAGAN VALLEY, SIMILKAMEEN DISTRICT.

By R. D. McCaw.

November 29th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—In accordance with your instructions, the photo-topographical survey of the Okanagan Valley has been extended southerly on the east side of the Okanagan River from Penticton to the International Boundary, and I submit the following report upon the field operations carried on in this connection during the past season:—

The instruments used were practically the same as those used in 1917, the two cameras and one small transit having been loaned again by J. J. McArthur, Boundary Commissioner of the Dominion Astronomical Observatory, Ottawa. Cramer's slow isochromatic plates were used in photography, some 35 dozen being necessary to cover the area. For triangulation the same instrument of previous years was used, with circle graduations reading to 20 inches. The triangulation was carried south to the International Boundary from stations of previous years, six new primary stations being used, two of which have been located by the Geological Survey of Canada. As a large area was to be covered in a short season, the triangulation-work lacks some readings which I desired to have from 1914 stations, but time would not permit of occupation of these. However, sufficient readings were taken to give complete connection between the various triangles. Connections were made in several instances to monuments on land-survey lines.

Actual field-work extended over a period of a little more than two months, photographic work and triangulations being run simultaneously as in previous years. Two camera parties operated every day that it was possible.

Season's Operations.

My assistant, T. Rognass, left here on August 8th, collected the camp outfit at Vernon, and made some of the preliminary arrangements at Penticton. He also commenced the erection of signals for future instrumental stations on the west side of the Okanagan River Valley. I joined him on August 15th and completed arrangements for the season. Signals were then erected to continue the triangulation to the International Boundary. The new primary stations consist of two Geological Survey stations—one south of Ellis Creek, the other on Apex Mountain south of Keremeos Creek; also Mount Kobau, Baldy Mountain, Incameep Reserve, and Osoyoos Lake (for boundary tie). Signals were still standing on the Geological Survey stations, so no preliminary trips to these were necessary. The other stations are new and trips were made to Baldy Mountain and Mount Kobau for the purpose of erecting signals before leaving Penticton. Baldy Mountain, on the east watershed and some eleven miles north of the International Boundary, was not difficult to reach, but the distance was considerable, the return trip covering ninety miles. Mount Kobau, on the west watershed, was reached from the main road along the river after a climb of about 5,000 feet. In order to facilitate this preliminary work, a motor-car was made use of

for transportation and thus delays from moving camp were eliminated. In addition to the erection of signals, several camera stations were occupied in close proximity to the Okanagan River.

On August 22nd a camp was located at the Penticton Municipal Reservoir on the South Branch of Ellis Creek. This reservoir is about sixteen miles from Penticton by wagon-road and pack-trail. The Carmi Wagon-road extends easterly from Penticton for a distance of about ten miles, the grade ending at the North Fork of Ellis Creek. A good pack-trail continues easterly towards Carmi, while a branch trail leaving this leads to the reservoir and eventually to Shuttleworth Creek. Penticton has two reservoirs in this locality, a small storage-site lying to the west of the main reservoir. The small reservoir has a very small watershed. Generally the character of the country in the locality is broken and a good number of camera stations were required. While at this camp the Geological Survey station south of Ellis Creek was occupied. The position of this is on a timbered ridge and a great deal of clearing was necessary before sights to other stations could be taken. The timber-growth in this vicinity is usually jack-pine, with spruce and balsam in the higher elevations. The entire area south of the upper part of Ellis Creek and extending to the Shuttleworth Creek Divide has been the scene of fires in years gone by. Much of the country is covered with a tangle of windfalls, which on steep slopes makes travelling hazardous. Intermingled with this is a growth of small jack-pine and spruce. That portion in the vicinity of the east boundary of Lot 2710 between Miles 16 and 20 is the worst area of windfalls I have found in the Okanagan Valley. A great deal of standing dry timber exists over the area as well.

Shuttleworth Creek was the next base of operations. This stream is fed mainly by swampy meadows, with a few small lakes. The North Fork is a small stream flowing from a lake in Sub-lot 16. A dam has been built to create a storage-site here, but the intended reservoir has not been filled. The upper part of the main stream flows through a gently falling valley with non-precipitous sides. The lower part of the creek flows through a deep canyon until the benches of the Okanagan River Valley are reached. The junction with the last-named stream occurs about half a mile south of Dog Lake. The Ellis Creek pack-trail extends towards Shuttleworth Creek, and thence easterly and northerly to the reservoir-site meantioned as being on Sub-lot 16. A poor trail extends westerly along the north side of the creek to the wagon-road at Shuttleworth's ranch. The north slope of the upper part of the creek is almost devoid of windfalls, the growth consisting of open jack-pine usually. The south slope is generally covered with a small growth, with windfalls, running into spruce and balsam, to the east. A very good pack-trail was found paralleling the east boundary of Lot 3639 and a little to the west of this limit. I believe it extends from Wilkinson Creek to McIntyre Creek (Sawmill Creek).

From a camp near the mouth of Shuttleworth Creek stations were occupied east and west of the Okanagan River and in the vicinity of McLean Creek. This latter stream is but a small one heading between Ellis and Shuttleworth Creeks, the outlet into Dog Lake being almost opposite Kaleden. Smoke from forest fires gave a poor atmospheric condition at this period and distance was difficult to photograph. The main valley from Dog Lake south is much broken by small isolated hills separated by narrow and sometimes fairly wide valleys. As a rule these hills have one or more precipitous sides, and near the mouth of McIntyre Creek this particular feature seems to reach the climax. McIntyre Bluff, west of the Okanagan River, is a well-known feature. It drops sheer for about 500 feet, with rock-slides at the river's edge.

McIntyre Creek (Sawmill Creek) is the largest tributary to the Okanagan River south of Dog Lake. The drainage area is large, five branches contributing a large volume of water to the main stream in the spring and early summer. The main stream for six miles back has a rapid fall over a bed of clean-washed boulders. At about two miles back a perpendicular canyon is entered, the sides being between 200 and 300 feet high. The tendency of all slopes on the lower part of the creek is to be very steep, and mud-slides are not uncommon along the bottom. The system is fed by meadows and small lakes, the greater part of the water coming from a mountain-mass to the north-east and from Baldy Mountain. The upper watershed is generally well timbered with the usual jack-pine, spruce, and balsam. In lower elevations southern exposures show some grassy slopes, and the north slope of the lower portion is an extremely steep grass slope, so steep that stock does not take readily to it, although a luxuriant growth of bunch-grass covers it. A forest fire in 1917 damaged a large portion of the timber-growth on the lower six miles. Owing to the steep slopes there is no good trail on the lower part of McIntyre Creek. A fair trail

extends from Shuttleworth Creek across the North Fork of McIntyre Creek, and then follows the north side of the main stream easterly towards the Kettle River. A trail from Incameep Creek joins this near the North Fork of McIntyre Creek.

From a main camp at the Fairview Bridge the balance of the south end of the work was completed. A week of fine clear weather from September 21st enabled us to do numerous stations along the main valley in the vicinity of Incameep Indian Reservation and Fairview. A primary station (Mount Kobau) was occupied during this week. From this mountain a splendid view was obtained in all directions and many signals read. Rain set in about the 28th, and from that date until we finished wet weather hindered us a great deal. In addition, the atmosphere became very smoky again, and this condition continued for over a week. A fly camp was taken up the Camp McKinney Road for the purpose of occupying Baldy Mountain as a primary station. Rain and smoke made the occupation of this station tedious and we were delayed some three or four days. The right-of-way of the West Kootenay Power and Light Company passes over the south end of the Baldy Mountain Ridge and about four or five miles south of the summit. Active clearing operations were going on in this locality, the right-of-way having been already cleared from the Kettle River to the Kettle Valley-Okanagan Divide.

Incameep Creek and Wolf Creek form the source of water-supply for irrigation in the Incameep Indian Reservation. The former is the larger and has its source on the east watershed. The drainage area which embraces part of Baldy Mountain is well timbered, tamarack being much in evidence. The old freight-road leading from the main valley to Camp McKinney ascends through the Incameep Basin and connects with the Kettle River Valley. The West Kootenay Power and Light Company is improving the grade of this road and widening the clearing. At the lower end near Okanagan River a portion of the old road is almost impassable on account of sand-hills. To overcome this obstacle a deviation was made and a good grade is being constructed.

On October 9th the primary triangulation was extended to the International Boundary and connection made to Post 117. Two camera stations were occupied west of Osoyoos Lake to complete photographic work in this locality. Camp was then moved to Penticton and several triangulation and camera stations completed in that vicinity. The party was paid off on the 14th, with the exception of one man whom I retained to accompany me to Apex Mountain and up Ellis Creek to make a tie to the east boundary of Lot 2710. Apex Mountain (about 7,300 feet in elevation), as I mentioned previously, is a primary triangulation station south of Keremeos Creek. Readings were taken from this station to all primary signals visible. A branch road running southerly from the old freight-road along Keremeos Creek took us to an old mining property near the top of the mountain. The balance of the trip was over open slopes. Three days were occupied in the trip to Apex Mountain and return to Penticton. Bad weather with snow followed us up Ellis Creek, and the existing windfall conditions on steep slopes made it impossible to get the connection desired. However, a tie was made to Sub-lot 4, which had been connected with Mile-post 18 on the east boundary of Lot 2710. This concluded the field-work, and according to your instructions the camp outfit was stored at Penticton.

For transport, pack-horses were hired for the season, while a motor car or truck was hired when necessary along the main road. The following gives the number of stations occupied:—

Primary triangulation stations	5
Secondary triangulation stations	4
Photographic stations	54
Separate camera stations	104

General.

The past season was rather exceptional for the Okanagan Valley, in that there was a great deal of rain during July and August. The early part of the summer was dry and the atmosphere was clouded with smoke from forest fires. The rains following cleared up this condition and the growth became green and luxuriant down to the bottom of the valley. This in the middle of August is not the rule for wild growth in the Dry Belt. Another hot, dry period followed from about August 20th to the end of September and the grass was soon dried up again. Forest fires became numerous, causing smoky atmospheric conditions, very detrimental to good photographic work. The fall rains commenced the last week in September and wet weather followed us to the completion of the work.

The area covered this year is more or less a grazing country and the lower hills seem to be well stocked. Small areas of orchard lands are seen around Dog Lake, but from Vaseaux Lake south very little cultivation is done other than a few hay-fields. A large area of the present sage and grease-wood covered country could be brought under cultivation with an efficient irrigation system.

Very little game was seen, although there seems to be plenty of deer. Sheep may be seen between Ellis and McLean Creeks. Bears seem to keep away back and are almost altogether black, although the Indians say there are some grizzlies near Baldy Mountain. Grouse were plentiful. It would hardly be fair to leave out the rattlesnake. These reptiles are very numerous in the lower elevation; fifteen were killed by members of the party during the season.

Map-work is now being proceeded with, the area covered being about 350 square miles. As a direct tie now exists between the Armstrong Astronomical Station and the International Boundary, the geographic positions may now be revised and the triangulations corrected for the first time. The final photographic work is all being done here this year in the new dark room of the Survey Branch. This includes photographic enlargements from the negatives, which previously have been made in Ottawa.

I have, etc.,

R. D. McCAW, B.C.L.S.

SURVEY OF THE BOUNDARY BETWEEN THE PROVINCES OF ALBERTA AND BRITISH COLUMBIA.

BY ARTHUR O. WHEELER.

December 30th, 1918.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—During the season of 1918 the survey of the Interprovincial Boundary was carried on by the two divisions heretofore engaged upon the work—viz., that of R. W. Cautley, D.L.S., Commissioner for the Dominion and for Alberta, having in charge the survey of the watershed across the passes of the main divide of the Rocky Mountains and the construction of monuments to mark the same, and that of A. O. Wheeler, B.C.L.S., Commissioner for British Columbia, in charge of the photo-topographical delineation of the watershed between the passes and the mapping of the country adjacent thereto.

INSTRUCTIONS.

It was found necessary for the time being to detach Mr. Cautley's division from the survey of the passes and apply it to the survey of a portion of the 120th meridian in the vicinity of Swan Lake, in the Peace River District, where the said meridian was the dividing line between the two Provinces, owing to the fact that considerable settlement had taken place in that portion of the district.

The topographical division was instructed to continue the survey of the watershed northerly from the point in the vicinity of Howse Pass where it had been discontinued the previous season.

SURVEY OPERATIONS.

Acting under instructions from the Surveyor-General of Dominion Lands, Mr. Cautley proceeded with his party to Pouce Coupe, where the exact longitude had been established by Mr. McDiarmid, D.L.S., the previous year.

In accordance with his instructions, Mr. Cautley established a concrete monument at the nearest suitable point to the intersection of his connecting line with the 120th meridian, said point being 3.334 chains north of the said intersection, and then ran the boundary south. By the end of the season he had succeeded in establishing a little over eighteen miles of the boundary, the last monument erected being No. 74-8, which is a few chains south of the north boundary of Township 74 and about one mile and a half south of the Grande Prairie and Fort St. John Wagon-road and the Government Telegraph Line.

Owing to failure on the part of the contractors for the brass plates required to mark the monuments either to manufacture and forward the plates as agreed or to inform the Department

that they had not done so, he had no plates available for the work until the 16th September and was unable to build any monuments until after that date. Twenty-one concrete monuments were built in all during the season. In accordance with the decision of the Commission the monuments were marked with the number of the township of the Dominion lands system in which they occur, followed by the number of the particular monument in order from the south boundary of the township. Thus the first monument built north of the south boundary of Township 77 is marked 77-1, and so on.

Surveys were made to connect the survey of the boundary with the north boundaries of Townships 75, 76, and 77 respectively, and the strip of land between the boundary as established by Mr. Cautley and the one formerly surveyed to the west of it was found to be 18.304 chains on the north boundary of Township 76 and 18.227 chains on the north boundary of Township 75. Under instructions, Mr. Cautley ran levels and check-levels from B.M. 9, being 180 feet east and 10 feet south of the north-east corner of Section 36, Township 76, Range 14, to the intersection of the boundary with the north boundary of Township 76, from which point he ran levels and check-levels to monument 78-1 at the northerly extremity of the completed line, and afterwards from the same point he ran a single line of levels south to monument 75-1, and from thence along the Grande Prairie Wagon-road westerly to T.B.M. 156.

Character of Country surveyed.

Mr. Cautley states that along the north boundary of Township 77 from Pouce Coupe to the 120th meridian the line crosses two main ridges lying north and south, with approximate altitudes of 2,690 and 2,630 feet respectively, both being over 600 feet above the crossing of Pouce Coupe River; the soil is good and the surface is covered with thick poplar woods.

Through Townships 77, 76, and 75 the boundary runs in a hilly, timbered country, intersected by four high, flat-topped ridges from 150 to 600 feet above the intervening valleys. Most of the land in the valleys is suitable for homesteads and the soil is a rich loam that has been somewhat badly burned by forest fires in some places. Owing, however, to the generally hilly nature of the country and to the fact that the valleys are comparatively narrow and broken by small muskegs, the country is more suitable for stock-grazing than for farming at the present time. The surface can easily be cleared of its comparatively worthless timber by fire, and will then bear a heavy growth of wild grasses, peavine, and wild vetch, so that it will be possible to put up winter feed; this is essential, since he was given to understand by various stockmen of the district that the snowfall is heavy, and that it is necessary to feed stock from four and a half to five months, although horses have been known to winter out on the range. He saw some very fine hay lands along Tate Creek and the Pouce Coupe River which, he was told, had been covered with poplar and only burned for the first time four years ago. It is quite possible to burn such small timber as exists without injuring the soil if fires are set only when the soil is full of frozen moisture; at the same time nothing can be more disastrous to the future of the country than setting fires indiscriminately. Some of the land along the boundary has evidently been burned in the summer, so that every particle of humus has been burned out of the soil, and what was excellent land before the fire is rendered so worthless that it will take, perhaps, 100 years before the damage can be repaired by nature.

The whole country-side seems to be underlain by some porous form of substrata, if one can judge from the small and uncertain flow of the creeks, which does not seem to be in proportion to the watershed areas drained or the average precipitation. The Pouce Coupe River itself, which is the main drainage-channel of the district, carried a very small quantity of water towards the end of September, and several of the smaller creeks had dried up altogether.

Swan Lake.

Swan Lake was passed in Township 75 and is a pretty lake three miles long in a north-and-south direction. Former maps show the boundary to pass right through the lake, but it was found only to cut off a very small part from a little bay in the extreme north-east corner of the lake, although it follows the easterly shore for almost its entire length. Four permanent creeks empty into the lake, three small ones on its east side and a large one—named Tupper Creek on some of the published maps—from the south-west; at the north-west corner the lake empties into the South Branch of the Pouce Coupe River, which seems to carry about an equal volume of water as the East Branch crossed by the boundary.

GAME AND FISH.

Swan Lake is shallow and weedy along the shore and one of the finest water-fowl lakes for its size Mr. Cautley had ever seen; thousands of mallards and other good ducks breed there in summer, while geese were frequently seen, and swans were also reported. At the same time there must be deep water somewhere in the lake because whitefish are caught in it. Moose and bear were frequently seen on the line during September, and there are some mule-deer in the country.

DURATION OF WORK.

Mr. Cautley left Edmonton for Grande Prairie with four men on June 13th. He had tried to obtain all the seven men that he required ever since May 27th, but without success. A number of men came to see him in answer to advertisements, but wages were so abnormally high that even the excellent wages which he was enabled to offer were not sufficient inducement.

On October 7th he closed work and left for Grande Prairie, where he arrived on the 10th, when his party was paid off.

Mr. Cautley states that the party he had this year was not large enough to enable him to make progress satisfactory either to the Governments or to himself, and that owing to the scarcity of men it would have been impossible to get together a larger party in any case, but that now that the war is over it seems probable that there will be a number of suitable returned men whom the Governments will be anxious to employ next season.

TOPOGRAPHICAL DIVISION.

The topographical division, under Mr. Wheeler, organized at Banff and left that place for Field on June 25th. Travelling from Field to Howse Pass by way of the Amiskwi and Blaeberry Valleys, work was commenced on July 4th and the country west of Mount Conway covered, two stations on the watershed being occupied.

BUSH PASS.

Work was next carried to the Bush Pass and data obtained to enable the country lying along the watershed between that pass and Howse Pass to be mapped. The survey was also extended northward from the pass as far as the mountains surrounding permitted.

The summit of Bush Pass is a ledge of rock rising on the eastern side 500 feet or more above the valley-floor in a somewhat precipitous wall; it is inaccessible for horses. On the western side the ridge falls steeply 1,500 to 2,000 feet to the valley of a stream tributary to the Bush River. The gap of the pass at the summit is not more than half a mile wide between the mountain heights enclosing it. Owing to the pass being inaccessible for horses, all the work on the western side had to be done by back-packing in a very difficult and thickly wooded area.

HOWSE RIVER AND GLACIER LAKE.

On August 15th camp was moved to the mouth of Conway Creek, flowing northerly from Howse Pass to Howse River (Middle Branch of the Saskatchewan), and a peak, tentatively named Mount David, directly across Howse River occupied. Owing to bad weather two ascents of this peak had to be made before the required information could be obtained.

The party now moved down Howse River and established a camp at the head of the valley in which lies Glacier Lake. Glacier Lake is a fine body of water about three miles long by half a mile to a mile wide. It lies in a valley on the northern side of Mount Forbes and has its source of supply from a magnificent cirque of glaciers descending from the Mount Forbes, Mount Victor, and Mount Lyall groups of peaks and their incumbent ice-fields.

Two stations on the watershed were occupied, but owing to the wide ice-fields that had to be crossed it was found impossible to carry the work beyond it on the British Columbia side. All that could be done here was completed on September 2nd and the party then moved back to Howse River.

On September 4th Mount Sarbach, at the junction of Howse and Mistaya Rivers, was occupied, and on the 5th a move made for the Alexandra River (West Branch of the Saskatchewan) via Howse River and the Saskatchewan (North Saskatchewan). After three days' travel, for much of the distance over wide gravel flats intersected by numerous river-channels, camp was pitched directly at the summit of Thompson Pass.

Thompson Pass.

Thompson Pass Summit is a very picturesque spot, abounding in alpine meadow land interspersed with groves of spruce and balsam, and having two exquisitely coloured lakelets on the eastern approach and a small pond on the western. The gap is narrow, not much exceeding half a mile in width between the rock walls enclosing it. On either hand rises a sharp spire-like peak, that on the southern side having been named by Sir James Outram "The Watchman."

While there is a steep ascent both east and west of the summit, the approaches are not prohibitive to the construction of a road, and the central position of the pass and its distance from Howse Pass may in the future render it valuable for such a purpose as a means of communication with Bush River and the Columbia River on the western side.

Directly north of the pass rise the towering heights of Mount Bryce to close on 12,000 feet above sea-level, and northwards, beyond, lies the wide expanse of the great Columbia ice-field, with Mount Columbia rising a huge landmark from its western border. The ice-field sends out broad glacial streams in all directions—Saskatchewan Glacier, Athabaska Glacier, Dome Glacier, Columbia Glacier, and several others still unnamed. The area is collectively that of the highest peaks of the main range and is superbly picturesque in its varied features of towering rock, snow, and ice.

Beyond the watershed a path through the forest was cut for a distance of six miles down the valley of a tributary of Bush River, and two stations were occupied on the British Columbia side.

Alexandra River.

By September 15th all that could be done in the vicinity had been accomplished, and the party moved down the Alexandra River, occupying two stations on the northern side of the valley on the way out.

Alexandra River, like the Saskatchewan, has large stretches of gravel flat, with numerous intersecting river-channels flowing in many directions. It heads in a glacier from the Columbian ice-field, and some two or three miles from its source a branch valley leads westerly over the Thompson Pass. At the mouth are broad marshy meadows.

Close of the Survey.

On September 20th the party started for Lake Louise via Mistaya River and Bow Pass, being almost completely out of provisions. On the way out Observation Peak, at the summit of Bow Pass, was occupied to tie in the work with that of the previous season. The party was paid off on September 26th.

Game and Fish.

Rocky Mountain goat are seen high up on the peaks and are numerous. The tracks of elk and smaller deer are plentiful in the valleys, but the animals are wild and were seldom seen. Grizzly and brown bears were occasionally seen. The woods are full of grouse and ptarmigan frequent the alpine tracts above timber-line.

Fish are found in the Amiskwi and Blaeberry Rivers, but were not seen elsewhere and do not appear to inhabit waters so near the ice-fields.

Summary.

As a whole, the season has been fairly satisfactory. The country is very difficult of approach and much trail-cutting had to be done, a time-taking process for a party not equipped for that class of work. On the British Columbia side there are no existing facilities for approach to the watershed in the way of trails, and all had to be made, while wide ice-fields rendered the reaching of the watershed a matter of much difficulty and labour in most cases.

The latter part of July and the whole of August the weather was very bad for photographic surveying, which further added to the difficulties. September, on the other hand, was almost entirely fine, and not a day was lost except for the sheer necessity for an occasional rest from continuous climbing.

Taken altogether, the work is complete except in one part—viz., the basin at the head of Lyell Creek, which can be reached by going over the Thompson Pass and so carving a path to the valley of the main Bush River; or else by going down the Columbia River and up Bush River

from the mouth, an undertaking that would be out of the question, as it would require the best part of one season and be very expensive for so small a part.

Apart from natural difficulties, the unrest of war-time made labour a very uncertain proposition and the best of the kind required could not be had. I consider it a cause for congratulation that, all detriments considered, the work has been fairly satisfactory and has covered a very difficult section of the general area to be surveyed.

I have, etc.,

ARTHUR O. WHEELER,

Interprovincial Boundary Commissioner.

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1919.

PROVINCE OF BRITISH COLUMBIA

REPORT

OF

THE FOREST BRANCH

OF THE

DEPARTMENT OF LANDS

HON. T. D. PATTULLO, Minister

M. A. GRAINGER, Chief Forester

FOR THE YEAR ENDING DECEMBER 31ST

1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

Victoria, B.C., March 7th, 1918.

To His Honour Sir Frank Stillman Barnard, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

May it please Your Honour:

Herewith I beg respectfully to submit the Annual Report of the Forest Branch of my Department for the year 1918.

T. D. PATTULLO,
Minister of Lands.

The Hon. T. D. Pattullo,

Minister of Lands, Victoria, B.C.

SIR,—There are submitted herewith statistical tables with a brief comment thereon, covering the main activities of the Branch during the calendar year 1918.

M. A. GRAINGER,

Chief Forester.

REPORT OF THE FOREST BRANCH,
DEPARTMENT OF LANDS.

TRADE EXTENSION.

During the past year the fluctuating demand caused by the emergency nature of all business was reflected in the lumber industry of the Province.

The Prairie business was, as usual, very uncertain. The year commenced with good demand, and a good volume of business was done until about August, when the prospects of a light crop in many sections caused a curtailment.

The Eastern Canada market held strong throughout the year. It is estimated that over 150,000,000 feet of lumber, lath, and dimension was shipped during 1918. This is a record, and when compared with the 40,000,000 to 50,000,000 feet volume of pre-war business is very satisfactory.

The Department's Trade Commissioner visited the principal centres in Eastern Canada again during July and August. His report on this market may be summed up as follows: British Columbia, during the past two or three years, has obtained a footing which requires only sustained effort to secure for British Columbia timber a market for at least 250,000,000 feet a year. Our business can increase in all grades and all lines from box-shooks to clear timbers and finish. British Columbia lumber is in this market to stay, if the needs of the market are studied and our mills supply the material desired.

During the past three years some preliminary work has been done in investigation and development of overseas markets. While good railway systems provide adequate transportation facilities to the East, expansion to the West in the direction of Pacific markets of China, Australia, South Africa, and South America is strangled through lack of ships. Consensus of opinion is emphatic that round the Pacific is the real and ultimate overseas market for British Columbia timber.

At present Great Britain is the only market with shipping, and there is in addition an enormous emergency demand in sight for timber for reconstruction-work. In September the Department's Lumber Commissioner was sent over to England, and on the signing of the armistice all energies were bent to secure a full share of this business for British Columbia. Tonnage, of course, has controlled the situation. All importations to Great Britain have been handled by the Timber Controller, and up to the present any business which British Columbia could do must be through Government channels. Negotiations for large orders are still in progress at the time of writing this report.

The year 1918 has seen British Columbia timber most prominent in connection with the war. The rapid development of the Royal Air Force, with an ever-increasing demand for more machines, made spruce for aeroplane-construction of vital importance to the success of the Allies. In 1917 labour troubles threatened the source of supply from the Western States, and caused the Imperial Munitions Board to look to other sources for their raw material. The magnificent spruce stands of our Northern Coast offered a solution for the problem. Immense as these resources were, up to this time no serious effort had been made to exploit them for war purposes. Our total output of aeroplane spruce was an insignificant amount per month. Nearly all of it at that time was produced as a by-product in general commercial operations.

The British authorities were advised that in order to secure and maintain an adequate supply of aeroplane material an organized effort to secure the logging of the spruce regions would have to be made, and logging equipment and machinery would have to be transferred from the fir and cedar region of the Lower Coast to the Queen Charlotte Islands and Northern Mainland.

In fact, an industrial migration was necessary to provide not only for the logging of spruce, but also for towing, milling, and shipping of the largest obtainable quantities of it.

Towards the end of 1917 the Imperial Munitions Board sent a representative to British Columbia to investigate possibilities, and shortly thereafter the Board established at Vancouver a Branch of Aeronautical Supplies charged with getting an adequate supply of aeroplane lumber.

The factories of Great Britain and France were short of material. At a time when the United States had embarked on an aerial programme which would tax her productive capacity

to its limit a large portion of her output had to be shipped overseas to keep production going in France and England. Quick action was imperative. While the newly formed Imperial Munitions Branch was doing its utmost to secure cutting rights and establish operators, great delays were occurring in negotiations for suitable spruce areas. The Provincial Government therefore took drastic action, and commandeered all spruce timber by the following Order in Council:—

That the immediate supply of large quantities of aeroplane spruce is vital to the success of the war in the air.

That the Allies depend upon British Columbia, Washington, and Oregon to furnish this material.

That a most serious delay has already occurred in securing it, and that unless prevented further delays will continue to hinder immediate production.

That it would appear that one of the main causes of delay in the production of spruce is the time lost in negotiating for the right to cut standing timber.

That in this national emergency it is imperative that the Province of British Columbia shall contribute its full quota to the spruce production of the Pacific Coast.

That under these circumstances the Provincial Government finds itself obliged to take immediate and vigorous action to remedy the existing state of affairs, and for the reasons aforesaid to recommend:—

That the Minister of Lands be and he is hereby authorized and empowered:—

(*a.*) To forthwith arrange with the Imperial Munitions Board for the immediate logging of aeroplane spruce upon all areas of vacant Crown land that may be judged suitable for the purpose by the Department of Lands, as well as upon coal leases, coal licences, and mineral claims to which Crown grant or surface rights has not been issued:

(*b.*) To call upon all holders of Crown timber held under licence or lease which is judged by the Lands Department to be suitable for the purpose to proceed immediately with the logging of aeroplane spruce, and in default of compliance the Minister shall instruct the Department of Lands to arrange for such logging in co-operation with the Imperial Munitions Board:

(*c.*) To arrange with the Imperial Munitions Board on equitable compensation to be paid for timber so cut from any licence or lease.

This Order was subsequently supported by the "Spruce-cutting Act." Compensation was given to the owners of expropriated timber at a flat rate of $6 per thousand board-feet for No. 1 and $2.50 for No. 2 grade spruce logs. These figures were designed to cover waste in logging and all damages incidental to the selective logging of Nos. 1 and 2 spruce. While the powers under the Act for expropriation were exercised in comparatively few cases, their existence proved the necessary means to enable the Munitions Board to secure cutting rights without undue delay.

The Department in addition waived all the customary timber-sale procedure and allowed the cutting of spruce for munitions purpose under permit on all Crown lands.

The result of this organized effort to secure aeroplane spruce began to show early in the spring, and the production of accepted stock increased from month to month until the armistice was signed, as shown by the following table:—

SHIPMENT AND PRODUCTION OF AEROPLANE SPRUCE AND FIR, JANUARY TO NOVEMBER, 1918.

	Spruce, Feet.	Fir, Feet.
January	116,000	209,000
February	500,000	375,000
March	470,000	289,000
April	439,000	212,000
May	1,019,000	876,000
June	1,825,000	829,000
July	2,165,000	987,000
August	3,024,000	1,530,000
September	4,487,000	1,475,000
October	5,229,000	1,060,000
November	6,850,000	1,382,000
Total	26,124,000	9,224,000

At this time British Columbia was more than equalling the entire production of the Western States with all their resources in men and material, a result accomplished in eight months.

The Department issued 271 separate spruce permits, and in only eighteen cases was it necessary to use compulsion.

This selective logging of spruce was costly and extremely wasteful of actual wood material, as all No. 3 spruce, hemlock, and low-grade species were left uncut. This waste, however, is not a serious consideration when compared with the saving in time, when time meant a conservation of human lives more precious than any timber.

The shipping of 35,000,000 feet of aeroplane spruce and fir and the knowledge that we could, if necessary, continue to do so was no small factor in winning the war. The fine spirit of co-operation shown by the forest industries of the Province in this matter calls for especial notice.

Spruce Scaled for Royalty and charged to the Imperial Munitions Board.

Month.	Logs.	Rived.	Royalty, Scaling Fees, and Expenses charged.
April	2,474,385	.....	$2,034 33
May	5,047,738	.....	4,494 20
June	8,636,743	.....	7,533 94
July	8,168,815	.....	7,629 87
August	18,012,471	.....	16,098 22
September	15,780,102	.....	14,503 32
October	26,142,219	255,605	24,768 78
November and December	29,728,707	244,039	26,881 30
Totals	$113,991,225	$499,644	$103,943 96

The Timber Industry.

The final figures for the cut of the Province for 1917, compiled from returns supplied to the Forest Branch by the industry during 1918, are as follows:—

	Feet, B.M.
Lumber	1,200,544,000
Shingles, 2,390,000,000	239,000,000
Lath, 42,679,000	7,113,000
Poles, 3,654,000 lineal feet	5,481,000
Piles, 2,435,000 lineal feet	7,305,000
Hewn ties, 1,445,862 ties	46,267,500
Fence-posts, 11,755 cords	5,877,500
Mining-props, 67,668 cords	33,834,000
Total	1,545,422,000

	Feet.
Total production reported 1915	991,780,200
Total production reported 1916	1,161,750,000
Total production reported 1917	1,545,422,000

ESTIMATED VALUE OF PRODUCTION.

(These figures include transportation within the Province.)

From the appended table there will be noted a steady increase in value of production since 1915, and that 1918 figures are very nearly double those of 1915. The increase in value of about $6,000,000 over 1917 is probably accounted for by the high price obtained for spruce in 1918 and the gratifying increase in pulp production. Ship-building material also brought high prices, and a large quantity of timber was used in this new industry.

Product.	1915.	1916.	1917.	1918.
Lumber	$15,500,000	$21,075,000	$28,225,000	$26,219,697
Pulp	3,200,000	3,520,000	6,835,034	10,517,250
Shingles	3,500,000	4,500,000	6,900,000	5,805,417
Boxes	750,000	1,833,000	1,611,880	1,845,195
Piles and poles	1,200,000	650,000	467,695	394,871
Mining-props and posts	400,000	1,000,000	546,883	692,547
Miscellaneous (cut by railroads, mines, etc.)	900,000	1,150,000	1,425,815	1,773,821
Additional value constituted by the industry	1,750,000	1,650,000	2,145,880	1,689,810
Product of Dominion lands	1,800,000	*	*	4,953,329
Laths	150,000	150,000	142,282	120,278
Logs exported	.....	.....	.....	148,808
Totals	$29,150,000	$35,528,000	$48,300,469	$54,162,523

* Included in other items.

NOTE.—In addition to the total estimated value for 1918, there was an increase estimated at $840,000 in the quantity of logs on hand at December 31st, as compared with the corresponding date in 1917.

WATER-BORNE EXPORT OF LUMBER FROM BRITISH COLUMBIA.

Water-borne export of lumber from British Columbia in 1918 is shown in the appended table. It will be noted that the total of 88,069,029 feet is more than 100 per cent. increase over 1917 or 1916; 17,024,536 feet went to China and 19,803,335 feet to Japan, as against 1,672,871 feet and 1,590,246 feet respectively in 1917. War orders to the United Kingdom totalled 31,275,399 feet during the past year. These figures include 15,000,000 feet transhipped by rail for the United Kingdom.

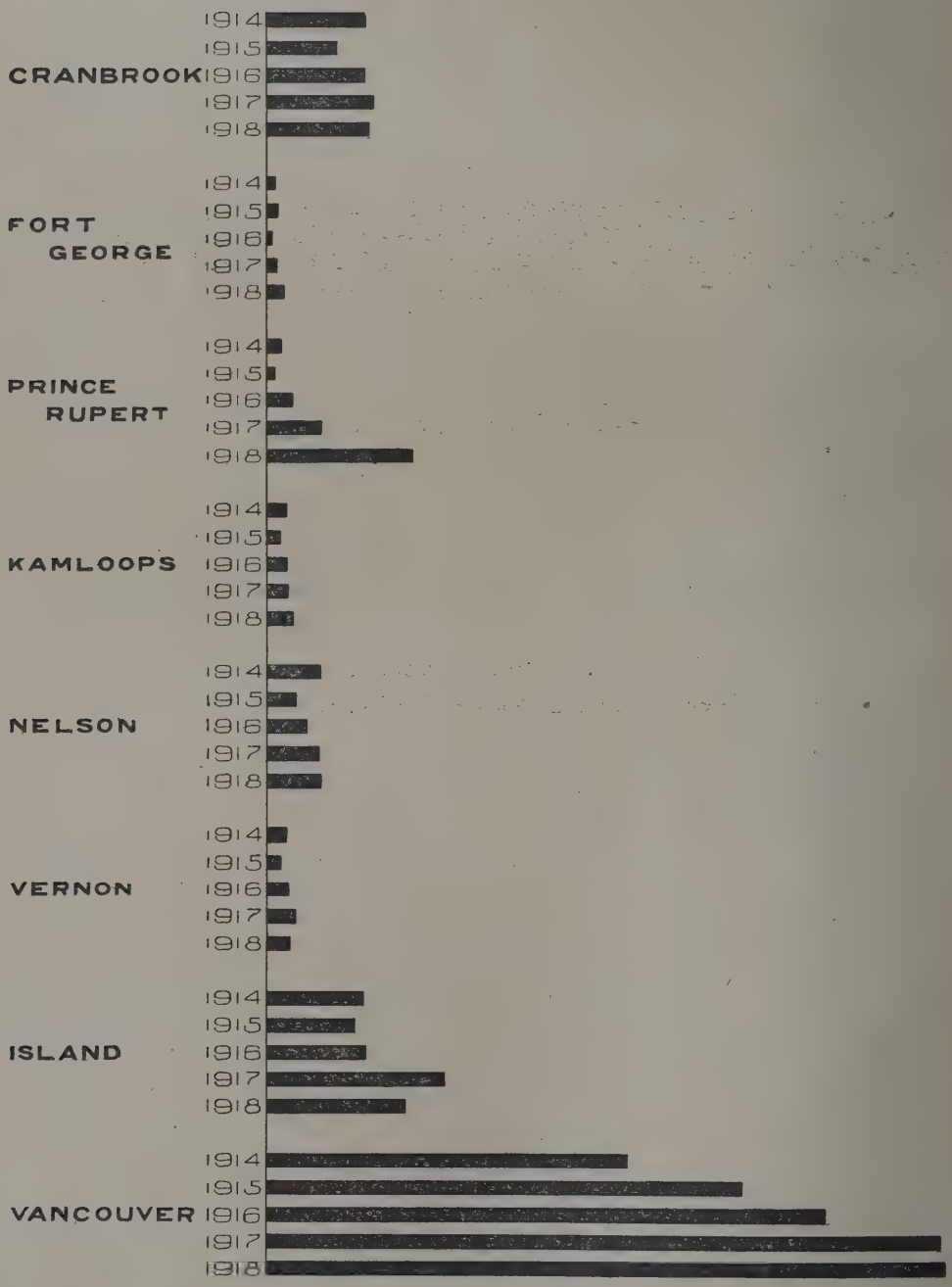
Destination.	AMOUNTS.		
	1916.	1917.	1918.
	Feet B.M.	Feet B.M.	Feet B.M.
Australia	2,152,657	16,309,307	6,434,145
New Zealand	286,421	122,984	55,960
West Coast of South America	627,418	2,616,652	2,464,121
China	3,055,045	1,672,871	17,024,536
Japan	3,042,690	1,590,246	19,803,335
South Sea Islands	991,308	1,610,715	2,564,064
United Kingdom and Continent	19,801,629	13,447,649	31,275,399
Africa	10,114,885	5,022,828	6,434,299
Alaska	3,564,654	.....	.....
Russia	39,816	.....	.....
California	1,373,938	.....	2,013,168
India	.....	1,529,014	.....
United States	.....	.....	.....
Totals	43,676,523	43,922,563	88,069,029

Timber Scaled in 1918 (by Months and Districts).

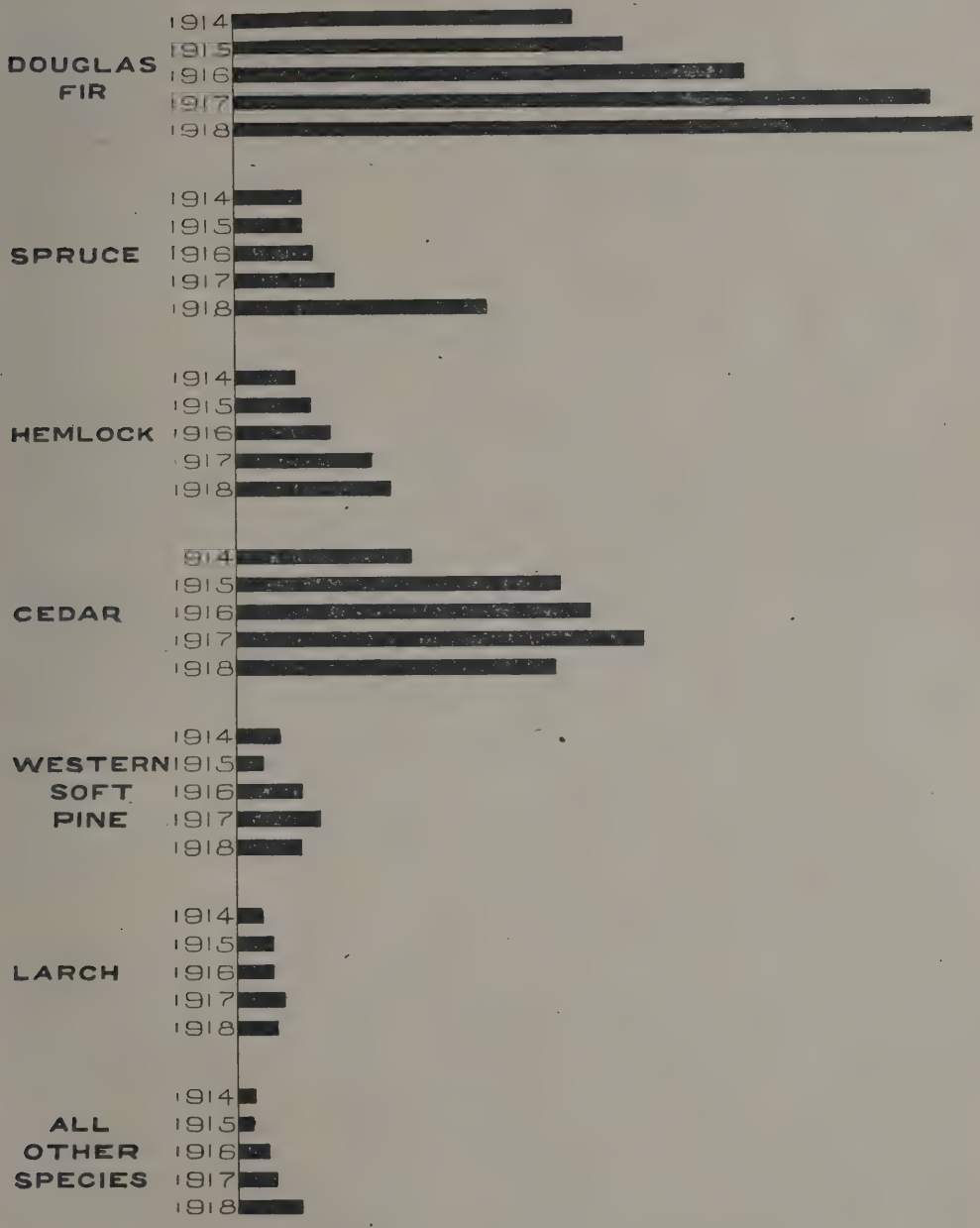
		Cranbrook.	Fort George.	Kamloops.	Nelson.	Vernon.	Island.	Prince Rupert.	Vancouver.	Total M.B.M.	Total Lineal Feet, Thds.	Total Cords.	Total Ties.
January	logs, M.B.M.	7,855	2,262	296	819	2,275	30,140	7,160	64,687	115,994	.....	.....	.....
"	lineal ft., thds.	10	22	6	44	17	5	9	7	.....	120	.....	.....
"	cords	3,842	.....	129	1,186	.....	1,836	34	10,469	.....	.....	17,496	.....
"	ties	8,079	.....	.....	9,521	.....	.....	.....	.....	.....	.....	.....	17,600
February	logs, M.B.M.	5,902	898	432	895	849	10,938	4,726	41,265	65,905	.....	.....	.....
"	lineal ft., thds.	3	.....	.....	74	50	142	4	14	.....	287	.....	.....
"	cords	976	17	220	1,898	.....	3,184	2,065	9,416	.....	.....	17,776	.....
"	ties	12,019	.....	.....	5,980	2,241	22,195	.....	.....	.....	.....	.....	42,435
March	logs, M.B.M.	8,941	987	932	4,512	2,127	14,023	3,158	54,876	89,556	.....	.....	.....
"	lineal ft., thds.	8	.....	21	33	36	.....	50	165	.....	313	.....	.....
"	cords	1,458	.....	510	2,017	.....	216	.....	8,970	.....	.....	13,171	.....
"	ties	2,935	.....	44,769	13,138	545	.....	.....	.....	.....	.....	.....	61,387
April	logs, M.B.M.	9,465	3,847	1,145	1,477	5,455	3,841	9,352	62,524	97,106	.....	.....	.....
"	lineal ft., thds.	16	.....	12	78	47	5	29	12	.....	199	.....	.....
"	cords	4,814	320	485	3,853	.....	2,615	15	17,200	.....	.....	29,302	.....
"	ties	13,241	.....	39,243	33,910	.....	.....	25,937	.....	.....	.....	.....	112,331
May	logs, M.B.M.	18,241	1,342	2,463	3,190	4,411	16,163	13,405	101,606	160,821	.....	.....	.....
"	lineal ft., thds.	56	.....	22	79	9	19	3	104	.....	202	.....	.....
"	cords	6,455	.....	471	1,021	20	133	.....	19,731	.....	.....	27,831	.....
"	ties	121,679	.....	35,449	8,806	779	.....	.....	1,909	.....	.....	.....	168,622
June	logs, M.B.M.	10,120	1,046	818	7,499	3,995	17,130	15,493	102,987	159,088	.....	.....	.....
"	lineal ft., thds.	50	.....	13	83	34	4	.....	32	.....	216	.....	.....
"	cords	2,548	144	391	4,215	.....	61	.....	10,353	.....	.....	17,712	.....
"	ties	48,445	.....	23,461	11,805	.....	.....	.....	.....	.....	.....	.....	83,711
July	logs, M.B.M.	12,157	2,333	6,983	6,788	4,030	19,322	21,302	81,913	154,828	.....	.....	.....
"	lineal ft., thds.	15	.....	25	451	22	.....	20	207	.....	740	.....	.....
"	cords	1,875	.....	519	2,583	.....	359	23	12,153	.....	.....	17,512	.....
"	ties	46,324	.....	.....	5,043	1,225	.....	55,100	.....	.....	.....	.....	108,592
August	logs, M.B.M.	15,298	3,395	4,037	6,642	3,649	24,095	36,567	88,021	181,704	.....	.....	.....
"	lineal ft., thds.	31	.....	35	235	39	2	27	193	.....	562	.....	.....
"	cords	1,352	.....	374	3,366	.....	260	.....	19,623	.....	.....	25,160	.....
"	ties	71,219	.....	58,464	16,526	773	.....	81,030	37,757	.....	.....	.....	265,769
September	logs, M.B.M.	8,095	2,032	3,836	5,623	1,895	16,032	33,603	75,994	147,800	.....	.....	.....
"	lineal ft., thds.	32	.....	68	106	78	68	19	155	.....	526	.....	.....
"	cords	1,805	76	115	783	.....	550	742	14,191	.....	.....	18,262	.....
"	ties	72,659	.....	31,483	4,239	.....	.....	.....	44,176	.....	.....	.....	152,557
October	logs, M.B.M.	9,980	1,583	3,973	5,104	1,375	22,450	21,325	88,417	154,207	.....	.....	.....
"	lineal ft., thds.	3	.....	11	47	14	6	18	239	.....	338	.....	.....
"	cords	894	.....	16	1,012	.....	575	.....	12,604	.....	.....	15,101	.....
"	ties	47,981	.....	.....	14,849	.....	.....	.....	45,916	.....	.....	.....	108,746
November	logs, M.B.M.	3,054	4,723	839	7,005	1,001	9,706	19,165	72,857	118,350	.....	.....	.....
"	lineal ft., thds.	18	.....	19	68	1	3	7	141	.....	257	.....	.....
"	cords	17,908	38	112	1,443	.....	49	2,047	10,018	.....	.....	31,615	.....
"	ties	48,874	.....	37,271	6,825	.....	.....	.....	.....	.....	.....	.....	92,746
December	logs, M.B.M.	2,697	934	1,560	2,004	537	16,510	21,169	78,707	124,118	.....	.....	.....
"	lineal ft., thds.	13	.....	8	299	39	.....	92	106	.....	557	.....	.....
"	cords	2,052	985	48	4,159	140	.....	659	18,917	.....	.....	26,960	.....
"	ties	10,966	.....	9,080	14,048	.....	.....	53,645	705	.....	.....	.....	88,444
Total	logs, M.B.M.	111,805	25,982	27,314	51,558	32,099	200,350	206,515	913,854	1,569,477	.....	.....	.....
"	lineal ft., thds.	255	22	240	1,597	386	254	278	1,375	.....	4,407	.....	.....
"	cords	45,979	1,580	3,390	27,536	160	9,838	5,770	163,645	.....	.....	257,898	.....
"	ties	504,421	.....	279,220	145,590	5,563	22,195	215,712	130,463	.....	.....	.....	1,303,164

Total, 1,761,184 M.B.M.

TIMBER SCALED BY DISTRICTS



SPECIES CUT



Note. Figures for 1914 shew sawlogs only
Poles, Piles Cordwood and Ties omitted

SPECIES CUT, 1918.

Forest District.	Douglas Fir, M.B.M.	Red Cedar, M.B.M.	Spruce, M.B.M.	Hemlock, M.B.M.	Balsam Fir, M.B.M.	Yellow Pine, M.B.M.	White Pine, M.B.M.	Jack-pine, M.B.M.	Larch, M.B.M.	Cottonwood, M.B.M.	Birch, M.B.M.	Aspen, M.B.M.	Maple, M.B.M.	Cypress, M.B.M.	Alder, M.B.M.	Total.
Cranbrook	45,537	9,193	8,161	5,611	13,884	35,884	1,623	1,090	30,764	299	...	....	....	....	....	151,828
Fort George	578	615	22,563	61	2,187	22	....	562	.....	295	1	1	....	....	...	26,885
Kamloops	27,449	6,714	4,309	108	346	151	555	....	.....	...	....	....	....	....	....	39,632
Nelson	10,143	29,795	1,714	13,006	191	5,772	6,843	197	10,066	118	11	....	....	....	....	77,856
Vernon	5,937	303	35	.....	.....	27,892	73	.....	38	...	....	....	....	....	....	34,278
Totals, Interior	89,644	46,620	36,782	18,786	16,390	69,721	9,094	1,849	40,868	712	12	1	...	....	....	230,479
Island	142,073	20,694	21,884	19,796	1,349	75	657	....	....	2	....	....	1	....	....	206,531
Prince Rupert	5,080	16,567	163,507	18,234	7,559	1	....	2,979	3,546	34	....	....	....	2	22	217,531
Vancouver	540,757	266,072	54,396	112,976	20,100	750	5,117	....	1,203	4,960	....	...	46	266	....	1,006,643
Totals, Coast	687,910	303,333	239,787	151,006	29,008	826	5,774	2,979	4,749	4,996	....	....	47	268	22	1,430,705
Grand totals, 1918	777,554	349,953	276,569	169,792	45,398	70,547	14,868	4,828	45,617	5,708	12	1	47	268	22	1,761,184
Grand totals, 1917	763,369	443,076	110,569	149,761	21,740	90,495	6,468	8,760	50,001	2,993	7	....	....	36	...	1,647,275

TIMBER-SALES.

A comparison of timber-sales awarded during 1918 with those of the three previous war-years, 1915, 1916, 1917, is shown in the appended table. Aeroplane spruce disposed of during the year under the "Aeroplane Spruce-cutting Act" is not included in this table, as no timber-sales were awarded in the spruce belt owing to the operation of this Act.

The total value to the Crown of timber included in sales made during 1918 is approximately $380,000. This includes royalty, rental, and taxes on all sales, less costs of advertising, cruising, etc. This figure does not include revenue from aeroplane spruce cut under permit for the season. The total for 1918 is less than 1917, but it is higher than any other previous year by 50 per cent.

Sales are awarded for a number of reasons, such as:—

(*a.*) The economic disposal of small blocks of timber adjacent to existing operations.

(*b.*) The logging of areas which are potentially agricultural:

(*c.*) To supply local demands for firewood, ties, and mine-timber in small lots:

(*d.*) The disposal of defective and infected timber to check the spread of insect and fungus or other forest enemies.

Each sale is considered separately, and is cruised, surveyed, and advertised before being sold by public auction.

A number of sales of interest occurred in 1918. Applications for the purchase of ties doubled in 1918 over 1917, a large number being purchased in Prince Rupert District for the purpose of retying a section of Grand Trunk Pacific track.

In the Interior there was a boom in applications for firewood owing to the scarcity and high cost of other fuel.

A number of sales were awarded in the Vernon District of insect-killed western soft pine. These sales followed the discovery of a considerable area between Princeton and Nicola infested with bark-boring beetles, which were killing the standing timber at an alarming rate. The infestation appeared to be spreading rapidly, and recommendation was made that the timber already killed and dying should be disposed of as a measure to combat the spread of the evil. Dead and dying trees, freshly cut stumps and tops were found to be the breeding-places of the insects. Sales were made to holders of adjacent timber licences which were also affected, and stands of insect-killed timber no longer suitable for mill purposes were sold for cordwood. The cutting of this timber was to be carried on with special reference to checking the spread of these beetles, and allowances were made in the upset price, so that tops and slash should be piled on stumps and the whole burned, so as to kill the insects and prevent their menace.

If co-operation on the part of the operators of valuable pine limits adjacent in these measures is secured, it is considered an effective check will be obtained to the damage which is threatened. About 200,000 feet B.M. of damaged timber was salved in this manner.

TIMBER-SALES AWARDED BY DISTRICTS, 1918.

Forest District.	No. of Sales.	Area in Acres.	Sawn Timber (Ft. B.M.).	Piles and Poles (Lineal Feet).	No. of Posts.	Shingle-bolts and Cordwood.	Railway-ties.	Estimated Revenue.
Cranbrook	27	3,782.3	3,911,000	130,750	.....	1,901	120,560	$ 19,827 51
Fort George	14	1,561	11,959,000	4,000	.....	1,327	.....	26,401 81
Kamloops & Lillooet	43	5,507	7,529,000	41,000	20,000	3,045	78,830	25,413 29
Nelson	12	897	2,205,000	72,900	.....	1,200	50,344	8,200 45
Prince Rupert	25	7,173.5	39,996,000	25,880	.....	400	440,670	68,179 46
Vancouver and Island	88	12,787	80,636,700	75,250	.....	7,207	11,250	201,844 78
Vernon	18	2,550	13,422,300	28,300	.....	3,398	.....	30,541 03
Totals, 1918	227	34,257.8	159,659,000	378,080	20,000	18,478	701,654	$380,408 33
Totals, 1917	255	44,914	240,307,057	1,517,450	40,000	43,756	381,200	$483,281 50
Totals, 1916	133	23,318	136,345,000	435,810	.....	26,666	92,000	$259,769 12

AVERAGE SALE PRICE BY SPECIES.

From the appended table it will be noted that stumpage prices bid on timber-sales reached a higher average in 1918 than in any previous year. A steady increase is noted on the five species which comprise the bulk of the timber sold. Douglas fir, spruce, cedar, hemlock, and balsam fir, in order, make up 90 per cent. of the total sales. On the other hand, prices on other species appear to be declining during the period. This is due to the fact that sales of fire-killed and insect-killed material, such as insect-killed western soft pine, are included.

Since 1915 the average selling-price of timber has risen considerably, and although logging and manufacturing costs have gone up greatly, the increase in stumpage was to be expected.

Average Sale Price by Species, 1918.

Species.	Sawn Timber.	Board-feet.	Average Price per M., 1918.	Price per M., 1917.	Price per M., 1916.	Price per M., 1915.*
Douglas fir	.....	48,017,270	$1 32	$1 12	$1 00	$0 95
Cedar	.....	28,623,350	1 36	1 24	1 16	1 10
Spruce	.....	35,624,900	1 02	96	72	71
Tamarack	.....	359,530	1 45	1 61	1 75	....
Hemlock	.....	25,758,360	60	48	45	46
Balsam fir	.....	7,453,400	62	54	39	48
White pine	.....	1,223,000	1 04	1 24	1 69	....
Western soft pine	.....	8,716,880	1 45	1 57	1 74	...
Other species	.....	3,882,310	1 82	1 88	1 95	....
Totals	.....	159,659 000	....	....	....	....

* These prices average in all districts and do not include royalty.

TIMBER CUT FROM TIMBER-SALES.

A comparison in the appended table of timber actually cut from timber-sales for the period 1915-18 shows a steady increase from year to year. The cut for 1918 doubled that of 1916, both in quantity and value.

The total cut of timber from this source amounts to only 7 per cent. of the total cut of the Province.

TIMBER CUT FROM TIMBER-SALES DURING 1918.

Forest District.	Feet B.M.	Lineal Feet.	Cords.	Ties.
Cranbrook	16,954,598	8,880	2,560	9,949
Fort George	6,139,458	.....	447	.....
Kamloops	6,985,884	194,757	2,063	68,237
Nelson	1,311,304	190,418	630	11,612
Prince Rupert	19,501,199	105,284	....	55,100
Vancouver	61,788,344	250	9,679	1,909
Vernon	1,246,823	.....	160	.....
Totals, 1918	113,927,610	499,589	15,539	146,807
Totals, 1917	99,078,832	545,429	14,862	34,937
Totals, 1916	63,055,102	225,799	8,425	.....

SAW AND SHINGLE MILLS OF THE PROVINCE, 1918.

Forest District.	SAWMILLS.		SHINGLE-MILLS.		SAWMILLS.		SHINGLE-MILLS.		SAWMILLS.		SHINGLE-MILLS.
	No.	Operating, with Estimated Daily Capacity.	No.	Operating, with Estimated Daily Capacity.	No.	Shut down, with Estimated Daily Capacity.	No.	Shut down, with Estimated Daily Capacity.	No.	Under Construction, with Estimated Daily Capacity.	Under Construction, with Estimated Daily Capacity.
Cranbrook	28	1,145,000	1	50,000	3	85,000	..	.....	1	25,000	....
Fort George	18	377,000	..	.....	1	130,000	..	.....	..	.....	....
Island	37	1,413,000	8	575,000	4	272,000	..	.....	..	.....	....
Kamloops	8	270,000	1	120,000	3	130,000	..	.....	..	.....	....
Nelson	27	514,000	10	875,000	4	200,000	..	.....	..	.....	....
Prince Rupert	26	428,000	2	200,000	..	.....	..	.....	1	75,000	....
Vancouver	60	4,085,000	53	9,600,000	10	640,000	5	675,000	..	.....	....
Vernon	15	405,000	..	.....	4	110,000	..	.....	..	.....	....
Totals	219	8,637,000	75	11,420,000	29	1,567,000	5	675,000	2	100,000	....

LOGGING INSPECTION.

There were 1,429 logging operations reported during the year 1918, 446 more than in 1917 and 585 more than in 1916. Twenty-two hundred and fourteen inspections were made on these operations by the Ranger staff of the Department. The object of these inspections on all classes of logging operations was to secure prompt transaction of business, give service to the loggers, and prevent trespass.

Inspection on Timber-sales.—Efforts were made to inspect operations on timber-sales once a month. Each timber-sale contract makes provision for the utilization of all merchantable material possible, penalties are provided for waste in tops and high stumps, merchantable timber not cut, and merchantable material cut and not removed. Each contract contains in addition a clause requiring disposal of brush and slashings under direction of an officer of the Forest Branch. It is necessary, therefore, to be on the ground frequently while cutting is in progress.

Inspection on all other Operations.—All other operations should be inspected once in three months to assist operators in matters of fire-protection, in tracing boundary-lines, and general supervision. The staff available for this work has been greatly reduced in the last two or three years owing to the number of enlistments of field officers of the Branch. During the fire season protection-work claims nearly all the time of those who remain. However, on the average, timber-sales were inspected every two months in 1918, and other operations on an average of once in eight months.

By a closer co-ordination of field-work a big improvement over last year was effected, and nearly double the total number of inspections were made with practically the same staff.

LOGGING INSPECTION, 1918.

Forest District.	Timber-sales.	Hand-loggers' Licences.	Leases, Licences, Crown Grants, and Pre-emptions.	Total Operations.	No. of Inspections.
Cranbrook	22	....	33	55	104
Fort George	12	....	31	43	53
Kamloops and Lillooet	106	....	65	171	170
Nelson	16	....	100	126	142
Prince Rupert	48	38	134 *	260	284
Vancouver and Island	121	133	448	702	1,376
Vernon	13	....	59	72	85
Totals, 1918	338	171	870	1,429	2,214
Totals, 1917	236	141	606	983	1,161
Totals, 1916	170	291	683	1,144	1,648

* Spruce permits.

TRESPASS.

Frequent inspection of logging operations may be relied on to prevent trespass cutting to a large extent. Poorly defined boundaries and ignorance on the part of loggers as to the limits of their operations are usually found to be the cause of trespass cutting. Intentional trespasses are becoming more infrequent each year.

The appended table shows fifty-seven cases in 1918. The total area cut over under trespass was 412 acres, and the average 7.2 acres for each case. In the beginning of the year there was considerable uncertainty as to what method would be adopted in handling the cutting of spruce for war purposes. Trespasses were committed before the machinery for handling spruce permits was in full swing, owing to mistaken impression which prevailed that spruce could be cut wherever found.

TRESPASS, 1918.

Forest District.	No. of Cases.	Area cut over (Acres).	Quantity cut.				No. of Resulting Seizures.	Amount.
			Feet B.M.	Lineal Feet.	Cords.	Ties.		
Cranbrook	5	101	230,000	....	72	....	3	$ 478 00
Fort George	1	4	87,000	....	....	....	..	65 25
Kamloops and Lillooet	7	103	443,000	10,000	...	354	..	881 49
Nelson	5	8	.....	....	179	100	..	96 60
Prince Rupert	18	...	3,433,954	4,296	....	....	1	255 74
Vancouver and Island	17	86	1,788,736	....	54	....	3	614 82
Vernon	4	110	495,265	25,380	...	....	1	401 90
Totals, 1918	57	412	5,477,955	39,676	305	454	8	$2,178 98
Totals, 1917	36	348	4,523,088	36,677	217	907	6	$2,245 43
Totals, 1916	72	1,046	4,472,106	69,873	1,397	....	16	$3,821 32

LAND CLASSIFICATION.

STATUS OF AREAS EXAMINED, 1918.

Forest District.	Lots.		Expired Timber Licences.		Pre-emption Records.		Applications to Purchase.		Miscellaneous.	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
Cranbrook	19	11,073	3	1,920	6	1,192	..	....	..	....
Fort George	85	28,821	..	....	59	8,475	.	....	9	1,485
Kamloops	25	3,042	..	....	25	3,677	..	...	1	123
Nelson	4	1,285	..	....	5	623	..	....	..	....
Prince Rupert	81	24,152	..	....	11	1.574	12	2,844	5	3,117
Vancouver	10	1,090	1	590	27	2,332	2	673	1	160
Vernon	46	7,226	..	....	14	1,627	1	58	..	....
Totals	270	76,689	4	2,510	147	19,500	15	3,575	16	4,885

CLASSIFICATION OF AREAS EXAMINED, 1918.

Forest District.	Total Area.	Agricultural Land.	Area recommended for Reserve.	Estimate of Timber on Total Area (M.B.M.).
Cranbrook	14,185	2,594	479	71,286,500
Fort George	38,781	18,718	408	14,115,000
Kamloops	6,842	2,806	.....	2,762,380
Nelson	1,908	225	.....	1,092,000
Prince Rupert	31,687	9,668	480	5,342,000
Vancouver	4,845	1,127	879	10,326,037
Vernon	8,911	3,325	.....	24,173,122
Totals	107,159	38,463	2,237	129,097,039

PRODUCTION PULP AND PAPER, 1918.

	1918. Tons.	1917. Tons.
Pulp—		
Sulphite	66,054	43,644
Sulphate	12,188	2,863
Ground wood	91,145	65,620
Paper—		
Newsprint	112,206	75,833
Wrapping	8,277	3,170

TIMBER EXPORTS.

EXPORT OF LOGS, 1918.

Species.	Grade No. 1.	Grade No. 2.	Grade No. 3.	Ungraded.	Total.
Cedar	329,214	1,849,659	2,441,287	.....	4,620,160
Fir	124,985	2,047,682	950,711	.....	3,123,378
Spruce	.....	2,794	6,335	.....	9,129
Hemlock	.....	.....	.....	3,823,200	3,823,200
Larch	.....	.....	.....	26,469	26,469
Other species	.....	.....	.....	5,931	5,931
Totals	454,199	3,900,135	3,398,333	3,855,600	11,608,267

EXPORT OF POLES, PILING, PROPS, TIES, AND WOOD, 1918.

Forest District.	Quantity exported.	Approximate Value F.O.B.	Where Marketed.	
			United States.	Canada.
Cranbrook—				
Cordwood	Cords, 1,760	$ 8,800	.....	1,760
Fence-posts	Cords, 13,199	91,393	.....	13,199
Mine-props	Cords, 12,597	88,179	.....	12,597
Poles and piles	Lin. ft., 281,301	19,691	.....	281,301
Mine-ties	Cords, 94	782	.....	94
Railway-ties	No., 444,975	200,238	.....	444,975
Fort George—				
Fence-posts	Cords, 77	481	.....	77
Island and Vancouver—				
Poles and piles	Lin. ft., 611,113	42,777	611,113	.....
Shingle-bolts	Cords, 76	760	76	.....
Kamloops—				
Fence-posts	Cords, 3,101	19,075	.....	3,101
Poles	Lin. ft., 184,840	10,770	39,295	145,545
Nelson—				
Fence-posts	Cords, 11,823	86,040	4,061	7,762
Piling	Lin. ft., 10,325	725	7,000	3,325
Poles	Lin. ft., 1,141,537	76,447	402,384	739,153
Vernon—				
Ties	Cords, 96	1,088	96	.....
Total	.....	$647,246	.....	.....

FOREST RECORDS.

FOREST REVENUE.

	12 Months to Dec., 1918.	12 Months to Dec., 1917.	12 Months to Dec., 1916.	12 Months to Dec., 1915.	12 Months to Dec., 1914.	12 Months to Dec., 1913.
Timber-licence rentals...	$1,372,789 28	$1,074,129 07	$1,138,879 22	$1,140,656 53	$1,555,980 28	$2,112,876 18
Trespass penalty	1,599 38	3,207 32	893 39	3,520 54	7,170 95	9,016 95
Royalty and tax.....	698,059 27	785,543 42	456,863 29	351,310 12	391,118 36	482,707 05
Timber-lease rentals.....	77,748 25	76,426 74	77,040 59	120,132 35	88,792 08	110,291 44
Scaling fees	56,304 90	62,381 50	32,590 20	27,893 16	30,472 32	23,978 99
Scaling expenses	9,753 29	6,055 74	3,158 71	2,564 71	1,803 82	1,759 41
Seizure expenses	2,813 82	507 11	1,364 84	85 71	270 90	.....
Licence penalty	79,605 09	11,928 01	28,524 00	16,692 69	25,335 00	24,291 00
Timber stumpage	151,598 86	113,498 13	68,779 87	67,250 42	36,545 33	18,719 92
Transfer fees	4,625 00	4,070 00	3,670 00	4,400 00	7,085 00	10,385 00
Hand-loggers' licence fees	2,975 00	9,700 00	7,100 00	5,550 00	5,200 00	5,025 00
Interest.....	69 67	68 04	100 09	1,117 81	115 13	17,208 84
Timber-mark fees.....	.....	.....	.....	137 00	508 50	924 50
Timber-sales rentals	7,753 84	9,457 72	5,235 35	3,830 89	3,477 87	2,597 95
Timber-sales cruising....	1,921 73	2,687 03	1,148 74	2,183 42	1,550 83	1,140 40
Timber-sales advertising.	1,152 40	1,183 35	391 89	532 71	534 05	691 40
Scalers' examination fees.	315 00	295 00	225 00	60 00	425 00	585 00
Copies of documents.....	1,980 70	561 53	401 80	128 00	569 57	.....
Exchange.....	1,637 91	470 61	45 22	17 33	61 96	119 95
General miscellaneous ...	.....	.....	.....	.....	.....	1,469 73
	$2,472,703 39	$2,162,170 32	$1,826,412 20	$1,748,063 40	$2,157,018 95	$2,832,788 71
Taxation from Crown-grant timber lands	258,105 14	176,163 20	179,528 56	174,495 00	185,661 00	166,540 00
Total revenue from forest sources ...	$2,730,808 53	$2,338,333 52	$2,005,940 76	$1,922,558 40	$2,342,679 95	$2,999,328 71

Revenue from Logging Operations, 1918.

Forest District.	Royalty and Tax.	Scaling Fees.	Trespass Penalties.	Seizure Expenses.	Scaling Expenses.	Stumpage.	Totals.
Victoria Head Office.....	$ 55,444 34	.....	.....	.....	.....	.....	$ 55,444 34
Vancouver	344,547 80	$39,470 03	$ 347 24	$ 630 40	$ 6,078 50	$ 78,699 69	469,773 66
Island	47,073 31	10,341 17	30 00	.....	1,341 31	.....	58,785 79
Cranbrook	82,431 74	.....	448 80	.....	.....	8,167 75	91,048 29
Prince Rupert	140,479 49	12,157 58	232 62	.....	4,513 17	20,564 92	177,947 78
Nelson.....	36,224 93	.....	280 65	5 00	.....	3,684 42	40,195 00
Vernon	14,400 16	.....	716 05	.....	.....	2,654 54	17,770 75
Fort George.....	18,856 24	.....	86 87	44 38	.....	10,238 11	29,225 60
Kamloops.....	14,223 57	.....	604 56	.....	.....	14,206 34	29,034 47
Totals, 1918	$753,681 58	$61,968 78	$2,746 79	$ 679 78	$11,932 98	$138,215 77	$969,225 68
Totals, 1917 operations	$605,669 50	$49,868 27	$2,071 96	$1,203 97	$ 5,099 95	$128,010 70	$791,924 35
Totals, 1916 operations	$500,574 76	$36,340 56	$1,713 85	$ 966 86	$ 3,422 24	$ 63,030 56	$606,048 83
Totals, 1915 operations	$401,383 84	$30,836 03	$2,313 15	$1,796 23	$ 3,210 62	$ 80,042 30	$519,582 17

FOREST EXPENDITURE.

The sums voted for forest-work for the fiscal year 1918-19 were as follows:—

Vote 129—Salaries	$132,876
Vote 133—Travelling expenses	20,500
Vote 135—Lumber-trade expenses	5,000
Total	$158,376

In addition to this total, sums were available from Vote 132 for temporary assistance and from Vote 133 for office supplies, maintenance of launches and autos, and miscellaneous expenses. The sum of $120,000 was also voted as the estimated amount of the Government's contribution to the Forest Protection Fund.

General Administrative Expenditure.

(For Nine Months, April to December 31st, inclusive.)

Forest District.	Vote No. 129: Salaries.	Vote No. 132: Temporary Assistance.	Vote No. 133: Expenses.	Total.
Headquarters	$11,427 72	.....	$ 9,496 35	$20,924 07
Cranbrook	3,775 01	.....	721 95	4,496 96
Fort George	2,998 54	.....	1,013 50	4,012 04
Island	5,880 33	.....	2,596 80	8,477 13
Kamloops	2,511 29	$ 689 00	1,270 50	4,470 79
Nelson	3,705 00	.....	734 38	4,439 38
Prince Rupert	14,378 38	.....	3,906 00	18,284 38
Vancouver	34,818 08	2,129 00	11,976 00	48,923 08
Vernon	2,823 70	2 50	1,108 42	3,934 62
Totals	$82,318 05	$2,820 50	$32,823 90	$117,962 45

FOREST PROTECTION FUND.

The statement appended will show the standing as at December 31st, 1918, of the above funds:—

Brought forward from 1916-17	$ 4,986 76	
Collections, fiscal year 1917-18	104,648 33	
Government's contributions	104,658 33	
		$214,293 42
Expenditure, fiscal year 1917-18	$211,887 05	
Less refunds	9,614 58	
		202,272 47
Balance to credit of fund		$ 12,020 95
Balance to credit of fund at April 1st, 1918	$ 12,020 95	
Collections, April to December, 1918 (nine months)	109,225 78	
Government's contributions, April to December, 1918 (nine months)	109,215 78	
		$230,462 51
Expenditure (nine months)	$228,774 86	
Less refunds (nine months)	3,810 49	
		224,964 37
Balance to credit of fund on nine months' working		$ 5,478 14

Forest Protection Expenditure.

	Fiscal Years.					
	1913-14.	1914-15.	1915-16.	1916-17.	1917-18.	1918-19 (9 mos. April 1st to Dec. 31st, 1918).
Patrols	$217,093	$228,352	$157,432	$144,251 28	$100,304 87	$157,170 50
Improvements	104,000	31,385	5,151	3,747 86	20,111 39	24,200 30
Fires	9,600	143,461	19,449	7,124 45	91,470 79	47,404 06
Totals	$330,693	$403,198	$182,032	$155,123 59	$211,887 05	$228,774 86

Expenditure by Districts for Nine Months ending December 31st, 1918.

Forest District.	Patrol.	Improvements.	Fires.	Total.
Headquarters	$13,865 53	.....	.....	$13,865 53
Cranbrook	14,079 98	$ 1,898 43	$10,207 98	26,186 39
Fort George	16,796 16	4 83	100 35	16,901 34
Island	13,881 38	240 13	15,999 94	30,121 45
Kamloops	10,847 98	.....	915 66	11,763 64
Nelson	14,968 01	708 83	7,280 15	22,956 99
Prince Rupert	20,157 02	.....	858 20	21,015 22
Vancouver	42,293 29	20,638 46	10,765 62	73,697 37
Vernon	10,281 15	709 62	1,276 16	12,266 93
Totals	$157,170 50	$24,200 30	$47,404 06	$228,774 86

Monthly Patrol Expenses, 1918.

District.	April.	May.	June.	July.	Aug.	Sept.	Oct.-Dec.
Headquarters*	$ 646 26	$7,605 73	$ 595 54	$1,491 00	$2,069 38	$ 698 21	$ 759 41
Cranbrook	990 90	1,309 75	1,612 23	3,889 35	3,351 69	2,211 94	714 12
Fort George	1,265 45	3,169 07	2,932 83	2,872 97	2,886 10	2,763 22	906 52
Island	1,041 34	1,677 50	2,260 73	2,894 89	2,999 02	2,270 19	737 71
Kamloops	469 88	1,857 75	1,682 66	2,168 18	2,154 55	1,778 91	736 05
Nelson	725 53	2,118 73	2,311 37	3,766 72	3,389 99	1,837 39	818 28
Prince Rupert	2,692 35	3,091 66	3,129 66	4,146 44	3,167 29	3,737 92	191 70
Vancouver	4,450 31	5,617 93	6,444 69	7,455 28	6,508 13	6,629 32	5,187 63
Vernon	408 19	1,310 03	1,358 23	2,492 45	2,703 73	1,631 25	377 27
Totals	$12,690 21	$27,758 15	$22,327 94	$31,177 28	$29,229 88	$23,558 35	$10,428 69

* Out of this amount the sum of $6,717 was paid for ten Ford runabouts and box attachments, distributed as follows: Cranbrook District, 3; Fort George District, 1; Kamloops District, 1; Nelson District, 1; Prince Rupert District, 1; Vancouver District, 3; Vernon District, 1. Also $2,230 was spent in special forest-protection advertising.

CROWN-GRANT TIMBER LANDS.

	Area of Private Timber Lands.	Average Value per Acre.
1911	824,814	$8 72
1912	874,715	8 60
1913	922,948	9 02
1914	960,464	9 66
1915	913,245	9 55
1916	922,206	9 73
1917	916,726	9 61
1918	896,188	9 60

The extent and value of timber land in the various assessment districts are shown by the following table:—

Forest District.	Acreage, 1918.	Increase or Decrease in Acreage over 1917.	Average Value per Acre.	Change in Value per Acre since 1917.
Victoria	14,246.40	-390.60	$13 45	-0.06
Cowichan	87,825.01	+746.01	14 85	-0.02
Alberni	43,878.00	-490.00	21 20	+2.89
Nanaimo	78,476.40	+232.40	11 57	-1.26
Comox	211,803.24	-4,556.76	12 92	-0.72
Rossland	17,441.97	-7,036.03	3 57	-0.16
Kettle River	5,094.05	-0.05	3 00	No change.
Slocan	44,422.19	-0.81	5 06	-0.23
Vancouver	6,660.00	-768.00	14 66	No change.
Nelson	172,914.44	-3,379.56	3 69	-0.08
Vernon	.....	-6,422.00	.....	-4.99
Golden	78,026.00	+240.00	3 86	No change.
Revelstoke	48,598.43	-0.57	11 74	+0.22
Fort Steele	86,802.56	+520.56	6 28	-0.11
Totals	896,188.00	23,044.38	$9 60	-0.01

TIMBER-MARKS.

	1917.	1918.
Old Crown grants	56	74
Crown grants, 1887-1906	41	64
Crown grants, 1906-1914	35	64
"Royalty Act, 1914"	133	178
Timber leases	15	16
Sixteen-year timber licences	2	...
Timber-sales	176	226
Dominion lands	22	39
Hand-loggers' licences	159	29
Hand-loggers' spruce permits	...	113
Totals	639	803
Transfers and changes of marks	142	
Hand-loggers' licences issued	112	

For convenience and field use the mark list is now compiled in two volumes: Volume 1, General Marks; Volume 2, Hand-logger Marks.

In Volume 1 the "Explanation" therein has been amplified, and a résumé of the mark regulations is also given.

CORRESPONDENCE.

Year.	Outgoing Mail.	Incoming Mail.	Daily Average.	Increase over 1918.
				Per Cent.
1918	49,000	33,500	196	16
1917	42,500	28,300	134	..

FOREST BRANCH ORGANIZATION.

DISTRIBUTION OF TOTAL FORCE, BRITISH COLUMBIA FOREST BRANCH, 1918.

	PERMANENT.										TEMPORARY.						
	Chief Forester and Foresters.	Assistant Foresters.	District Foresters.	Accountants and Inspectors.	Office Clerks and Draughtsmen.	Forest Assistants.	Scalers.	Cruisers and Compass-men.	Rangers.	Launch Crews.	Assistant Rangers.	Patrolmen.	Packers and Canoe-men.	Lookout-men.	Railway Patrolmen.	Rangers' Assistants, Compass-men, etc.	Others.
Cranbrook	....	....	1	....	1	....	1	....	3	....	5	8	....	2	....	....	....
Fort George	....	....	1	....	1	....	....	....	3	....	14	3	....	....	....	....	....
Island	....	....	....	....	....	....	3	....	3	2	4	8	....	....	....	....	....
Kamloops	....	....	1	....	1	....	....	....	2	....	6	7	....	....	....	....	....
Nelson	....	....	1	....	1	....	....	....	4	....	8	12	....	....	....	....	....
Prince Rupert	....	....	1	....	4	....	7	....	4	8	7	....	....	....	....	....	....
Vancouver	1	1	....	....	14	....	18	....	9	7	15	4	....	....	....	....	6
Vernon	....	....	1	....	1	....	....	....	2	....	5	10	....	....	....	....	....
Victoria Headquarters	1	3	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....

NOTE.—Victoria clerical staff combined. Land and Forest staff not shown separately.

DAMAGE CAUSED BY FOREST FIRES, 1918.

Table A.—Area Burned over and Damage to Forests.

Forest District.	Merchantable Timber destroyed or damaged.				Valuable Second Growth.		Cut-over Land, Unmerchantable Timber, Old Burn, not restocking.			Grazing Range.		Grand Totals.					
	Area.	Quantity Total Loss.	Quantity salvable.	Damage.	Area.	Estimated Damage.	Area.	Quantity killed.	Damage to Standing Timber.	Area.	Damage.	Area.		Quantity.		Damage.	
	Acres.	M. Ft. B.M.	M. Ft. B.M.		Acres.		Acres.	M. Ft. B M.		Acres.		Acres.	Per Cent.	M. Ft. B.M.	Per Cent.		Per Cent.
Cranbrook	2,276.00	460	944	$ 2,260 00	4,640.00	$10,605 00	10,600.00	.....	.....	3,800.00	$104 00	21,316.00	13.8	1,404.0	3.38	$12,969 00	20.01
Fort George	740.00	1,855	.....	805 00	514.00	2,070 00	10,676.00	.....	.....	3,374.00	100 00	15,304.00	9.9	1,855.0	4.47	2,975 00	4.60
Prince Rupert	50.00	10	.....	10 00	.....	.....	1,918.00	.....	.....	.....	.....	50.00	.....	10.0	0.02	10 00	0.01
Island	3,736.00	6,275	8,520	12,361 00	1,261.00	6,100 00	46,320.00	.....	.....	702.00	21 00	52,020.00	33.4	14,795.0	35.65	18,482 00	28.51
Kamloops	740.00	1,855	.....	805 00	514.00	2,570 00	10,676.00	.....	.....	3,374.00	100 00	15,304.00	9.9	1,855.0	4.48	3,475 00	5.36
Nelson	834.00	2,024	333	2,704 00	1,300.00	5,050 00	6,341.00	.....	$1,605 00	52.00	1 50	8,527.00	5.4	2,357.0	5.69	7,755 00	12.00
Vancouver	2,064.00	6,163	12,590	7,300 00	1,423.00	10,662 00	22,209.00	.....	.....	147.00	4 00	25,843.00	16.7	18,753.0	45.20	17,966 00	27.71
Vernon	260.00	461	.....	447 00	2,329.00	618 00	10,787.00	.....	.....	3,590.00	10 70	16,976.00	10.9	461.0	1.11	1,172 00	1.80
Totals	10,700.00	19,103	22,387	$28,771 00	11,989.00	$35,675 00	119,527.00	.....	$1,605 00	15,039.00	$ 427 50	155,340.00	100.0	41,490.0	100.00	$64,804 00	100.00
Per cent	6.88	46.05	53.95	44.40	7.71	55.05	76.90	.....	2.48	9.68	0.66	.....	.....	.....	.....	.....	.....
Totals, 1917	28,025.70	218,873	48,133	$103,218 95	16,225.60	$17,742 85	159,390.15	180.5	$220 00	33,647.55	$7,943 00	237,289.00	.....	267,186.5	.....	$129,124 85	.....
Per cent	11.80	81.92	18.02	79.95	6.80	13.74	67.20	0.06	0.16	14.20	6.15	100.0	.....	100.0	.....	.....	.....
Totals, 1916	15,304.00	47,653	2,757	$47,333 00	11,277.74	$219 00	111,045.36	.....	.....	23,661.37	$1,361 00	161,288.47	.....	50,415.0	.....	$48,913 00	.....
Per cent	9.0	94.5	5.5	96.7	7.0	0.5	69.0	.....	.....	15.0	2.8	100.0	.....	100.0	.....	100.0	.....

Table B.—Damage to Property other than Forests.

Forest District.	Products in Process of Manufacture.	Buildings.	Railway and Logging Equipment.	Miscellaneous.	Totals.	Per Cent.
Cranbrook	$ 4,655	$ 103	$ 4,000	.....	$ 8,758	4.72
Fort George	.....	10	.....	.....	10	....
Island	2,535	1,600	50,000	$14,828	68,963	37.12
Kamloops	1,600	17,900	50	275	19,825	10.70
Nelson	655	1,150	300	916	3,021	1.62
Prince Pupert	50	800	1,200	3,600	5,650	3.04
Vancouver	30,695	2,690	36,300	7,683	77,368	41.65
Vernon	1,000	150	1,000	.....	2,150	1.15
Totals	$41,190	$24,403	$92,850	$27,302	$185,745	100.00

Table C.—A Comparison of Damage caused by Forest Fires in the Last Seven Years.

	1918.	1917.	1916.	1915.	1914.	1913.	1912.
Total number of fires	910	986	864	1,031	1,832	578	347
Area burned over (acres)	140,085	237,289	161,288	244,189	355,124	10,270	160,000
Standing timber destroyed or damaged (M.B.M.)	42,886	267,186	50,415	187,250	102,804	3,845	200,000
Amount salvable (M.B.M.)	22,387	48,133	2,757	43,030	Not given.	Not given.	Not given.
Damage to forests	$ 25,930	$129,124	$48,913	$108,873	$ 72,057	$ 4,387	$200,000
Damage to other forms of property	200,335	162,333	26,962	57,774	364,475	13,967	113,273
Total damage	226,265	291,457	75,875	166,647	436,532	18,354	313,273

Cost of Fire-fighting.

Fires, 1918, classified by Place of Origin and Cost of Fire-fighting.

Forest District.	Total Fires.	Originated on Vacant Crown Lands and Lands paying Tax (F.P.).	Originated on Alienated Lands not paying Tax (F.P.).	Extinguished without Cost.			Cost Money to extinguish.			Total Cost of Fire-fighting.		Average Cost per Fire.
	No.	No.	No.	No.	Per Cent. of Total Fires in District.	Per Cent. of Total Fires in Province.	No.	Per Cent. of Total Fires in District.	Per Cent. of Total Fires in Province.	Dollars.	Per Cent. of Total spent in fighting Fires in Province.	Dollars.
Cranbrook	108	72	36	40	37.04	4.4	68	62.96	7.4	10,199	22.81	148
Fort George	58	6	52	52	89.7	5.7	6	10.3	0.6	96	0.34	16
Island	232	49	183	103	44.4	11.3	129	55.6	14.1	15,759	35.36	122
Kamloops	55	39	16	33	60.0	3.6	22	40.0	2.4	915	2.17	41
Nelson	154	61	93	62	40.26	6.8	92	59.74	10.1	4,928	10.13	50
Prince Rupert	32	9	23	23	71.84	2.5	9	28.12	0.9	858	2.04	95
Vancouver	167	53	114	107	64.67	11.8	60	37.13	6.8	10,772	24.17	173
Vernon	104	43	61	90	88.46	10.0	14	14.42	1.6	1,276	2.98	85
Totals	910	332	578	510	.....	56.1	400	.....	43.9	44,803	100.0	91
Per cent.	100.0	36 5	63.5	56.0	.....	.....	44.0	.....	.....	.....	.....	.....
Totals, 1917	986	257	729	625	.....	63.0	361	.....	37.0	88,243	100.0	244
Per cent.	100.0	26.1	73.9	63.4	.....	.....	36.6	.....	.....	.....	.....	.....
Totals, 1916	864	209	655	693	.....	80.0	171	.....	20.0	5,585	.....	32
Per cent.	100.0	24.2	75.8	80.2	.....	.....	19.8	.....	.....	.....	100.0	.....

Fires, 1918, classified by Size and Damage.

Forest District.	Total Fires.		Under ¼ Acre.			¼ Acre to 10 Acres.			Over 10 Acres in Extent.			Damage.		
	No.	Per Cent.	No.	Per Cent. of Total Fires in District.	Per Cent. of Total Fires in this Class.	No.	Per Cent. of Total Fires in District.	Per Cent. of Total Fires in this Class.	No.	Per Cent. of Total Fires in District.	Per Cent. of Total Fires in this Class.	Under $100.	Between $100 and $1,000.	Over $1,000.
Cranbrook	108	11.87	6	5.56	4.69	51	47.22	13.42	51	47.22	12.69	30	11	4
Fort George	58	6.37	12	20.69	9.37	29	50.0	7.63	17	29.31	4.23	4	.....	.....
Island	232	25.50	30	12.93	23.44	76	32.75	20.0	126	54.31	31.35	12	20	10
Kamloops	55	6.04	8	14.55	6.25	25	45.45	6.58	22	40.0	5.47	1	2	2
Nelson	154	16.92	45	29.22	35.16	63	40.91	16.58	46	29.87	11.44	24	12	4
Prince Rupert	32	3.52	2	6.25	1.56	16	50.0	4.21	14	43.75	3.48	2	2	1
Vancouver	167	18.35	16	9.58	12.50	66	39.52	17.37	85	50.90	21.14	12	17	16
Vernon	104	11.43	9	8.65	7.03	54	51.92	14.21	41	39.42	10.20	29	7	1
Totals	910	100.0	128	.....	100.0	380	.....	100.0	402	.....	100.0	114	71	38
Per cent.	.....	.....	14.07	.....	.....	41.76	.....	.....	44.17	.....	.....	.....	.....	.....
Totals, 1917	.....	.....	266	.....	.....	395	.....	.....	325	.....	.....	147	61	39
Per cent.	.....	.....	27.0	.....	.....	40.01	.....	.....	32.9	.....	.....	.....	.....	.....
Totals, 1916	.....	.....	230	.....	.....	336	.....	.....	298	.....	.....	127	50	15
Per cent.	.....	.....	26.6	.....	.....	38.9	.....	.....	38.5	.....	.....	.....	.....	.....
Totals, 1915	.....	.....	231	.....	.....	371	.....	.....	429	.....	.....	288	117	24
Per cent.	.....	.....	22.4	.....	.....	36.0	.....	.....	41.6	.....	.....	.....	.....	.....

CAUSES OF FIRES, 1918.

Table A.—Number and Causes of Fires, 1918.

Forest District.	Campers and Travellers.	Unknown Causes.	Operation of Railways.	Lightning.	Brush-burning.	Railway-construction.	Miscellaneous (known).	Industrial Operations.	Incendiary.	Public Road-construction.	Totals.	Per Cent.
Cranbrook	29	4	24	20	10	....	5	6	9	1	108	11.87
Fort George	17	12	3	5	14	....	2	1	3	1	58	6.37
Island	27	105	7	11	20	1	29	30	2	....	232	25.50
Kamloops	13	17	17	4	....	....	4	....	....	....	55	6.04
Nelson	9	23	38	60	17	....	4	3	....	....	154	16.92
Prince Rupert	9	17	2	....	4	....	....	....	....	....	32	3.52
Vancouver	10	54	.....	13	25	....	25	39	1	....	167	18.35
Vernon	44	12	13	21	10	....	3	1	....	....	104	11.43
Totals	158	244	104	134	100	1	72	80	15	2	910	100.00
Per cent.	17.36	26.81	11.43	14.72	10.99	0.11	7.91	8.80	1.65	0.22	100.0	....

Table B.—Number and Causes of Forest Fires for Last Eight Years.

Causes.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.
Campers and travellers	158	209	268	305	487	195	51	126
Unknown	224	214	148	160	367	104	149	126
Operations of railways (common carriers only)	104	335	121	82	361	110	34	31
Lightning	134	48	67	100	169	34	23	1
Brush-burning (to clear farm land, etc.)	100	48	148	267	164	26	47	14
Railway-construction	1	...	...	17	98	62	11	8
Miscellaneous (known)	72	55	19	24	83	7	6	3
Industrial operations (logging, etc.)	80	59	59	28	50	24	17	14
Incendiary	15	13	22	28	42	7	...	...
Public road-construction	2	5	12	20	11	9	9	8
Totals	910	986	864	1,031	1,832	578	347	331

BURNING PERMITS, 1918.

Forest District.	CLEARING AGRICULTURAL LAND.				CLEARING LOGGING-SLASH.				CLEARING RAILWAY RIGHT-OF-WAY.				CLEARING PUBLIC ROADS.				GRAND TOTALS.			
	Permits issued.	Area burned over.	Fires escaped Control.	Fires set without Permits.	Permits issued.	Area burned over.	Fires escaped Control.	Fires set without Permits.	Permits issued.	Area burned over.	Fires escaped Control.	Fires set without Permits.	Permits issued.	Area burned over.	Fires escaped Control.	Fires set without Permits.	Permits issued.	Area burned over.	Fires escaped Control.	Fires set without Permits.
	No.	Acres.	No.	No.	No.	Acres.	No.	No.	No.	Acres.	No.	No.	No.	Acres.	No.	No.	No.	Acres.	No.	No.
Cranbrook	147	894	.....	.....	12	57	.....	.....	5	15	.....	.....	2	2	.....	.....	166	968	.....	.....
Fort George	729	2,198	1	1	17	160	.....	.....	6	11	.....	.....	3	17	.....	.....	755	2,449	1	1
Hazelton and Prince Rupert	259	1,306	.....	.....	10	17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	269	1,323	.....	.....
Island	202	766	.....	.....	16	1,565	.....	.....	2	.....	.....	.....	2	5	.....	.....	222	2,336	.....	.....
Kamloops	236	1,128	.....	.....	5	19	.....	.....	6	16	.....	.....	2	3	.....	.....	249	1,166	.....	.....
Nelson	1,007	746	.....	4	7	335	1	1	2	82	.....	.....	2	5¾	.....	.....	1,018	746	1	5
Vancouver	268	963	.....	.....	30	481	.....	.....	3	26	.....	.....	7	3	.....	.....	308	1,473	.....	.....
Vernon	231	2,079	2	8	10	269	.....	.....	3	34	.....	.....	2	1	.....	.....	246	2,353	2	8

Prosecution for Fire Trespass, 1918.

Forest District.	Information laid.	Burning without Permit.	Incendiary.	Leaving Camp-fires burning.	Refusing to fight Fire.	Served Sentence in Gaol.	Fines.		Suspended Sentence.	Cases dismissed.
							No.	Amount.		
Cranbrook										
Fort George	1		1				1	$150 00		
Prince Rupert										
Island										
Kamloops										
Nelson										
Vancouver										
Vernon										
Totals	1		1				1	$150 00		
Totals, 1917	12	7	4		1		9	$477 65		3

PERMANENT IMPROVEMENTS.

List of Improvements in each District.

A total of $26,351 was spent on such improvements as telephone-lines, trails, boat-houses, and launch building and repairing during 1918. One launch is already in operation and two others are on the "slips." In addition, the increase of inspection-work in the Prince Rupert District, due to the war demand for spruce, necessitated the purchase of three new launches. A quantity of slash was burned at the expense of the Department this fall, thus tending to lessen the fire hazard for the 1919 fire season. Of the total sum disbursed, $10,407 was spent on the upkeep of existing improvements, upkeep of patrol-cars, with the necessary supplies of gasolene, oil, and tires. Ten new cars were added to the number already in the Forest Branch Service, materially increasing the efficiency of the fire patrol.

Maintenance.

Nelson—	
Big Bend Telephone Line	$ 180 51
Copper Creek Trail	1 30
Duncan River Telephone Line	125 29
Erie Relief Telephone Line	8 40
Kettle Valley Telephone Line	33 85
Mosquito Creek	3 03
Gas, repairs, oil, tires, etc., 2 cars	829 63
	$1,182 01
Prince Rupert—	
Gas, repairs, oil, tires, etc., 1 car	$ 148 10
Vancouver—	
Heriot Bay-Roy Telephone Line	$ 617 26
Lillooet Lake Trail	152 00
Gas, repairs, oil, tires, etc., 3 cars	1,387 57
	$2,156 73

Maintenance—Concluded.

Cranbrook—	
Baker Mountain Look-out and Telephone	$ 7 18
Elk Telephone	533 20
Goat Mountain Telephone	20 00
Repairs, gas, oil, tires, etc., 6 cars	2,361 01
	$2,921 39
Fort George—	
Gas, repairs, oil, tires, etc., 2 cars	$ 507 40
Island—	
Gold River Trail	$ 253 18
Gas, repairs, oil, tires, etc., accessories, 3 cars	1,659 47
	$1,912 65
Kamloops—	
Gas, repairs, oil, tires, 3 cars	$ 753 83

Improvements.

Nelson—	
Meadow Creek Trail	$ 2 20
Launch and Boat-house	225 00
Rapid Creek Trail	15 40
Sheep Creek Telephone Line	1 30
Slash-burning	50 85
Swan Creek Trail	6 30
Thrunis-Kinnaird Trail	25 65
Wilson Creek Trail	2 25
	$ 328 95
Vancouver—	
Block 439 Trail, Chilliwack	$ 12 10
Myrtle Point Telephone Line	387 34
Pitt River Trail	169 55
Powell River Boat-house	362 85
New Dinghies	620 51
Patrol Launch No. 1	1,062 01
Patrol Launch No. 2	1,563 73
Patrol Launch No. 3	3,338 80
Launch "Embree"	800 00
Launch "Export Patrol"	1,200 00
Rowboats	113 50
Thurston Bay Station	1,585 25
Launch "Gleam"	1,948 66
	$13,164 30

Improvements—Concluded.

Cranbrook—	
Horse Thief Trail	$ 21 05
Kootenay Trail	5 38
Lodge Pole Trail	133 30
Morrissey Meadows Trail	142 00
Plumbob Trail	3 25
Slash-burning	458 74
St. Mary Trail	4 25
Toby Creek Trail	12 68
Waldo-Twin Lakes Telephone Line	849 89
	$1,630 54
Kamloops—	
Adams Lake Cabin	$ 183 58
Rowboat, Blackwater Lake	54 50
	$ 238 08

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

PROVINCE OF BRITISH COLUMBIA

REPORT

OF THE

WATER RIGHTS BRANCH

OF THE

DEPARTMENT OF LANDS

HON. T. D. PATTULLO, Minister

E. A. Cleveland, Comptroller

FOR THE YEAR ENDING DECEMBER 31ST

1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

VICTORIA, B.C., February, 1919.

To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

Herewith I beg respectfully to submit the Annual Report of the Water Rights Branch of my Department for the year ending December 31st, 1918.

T. D. PATTULLO,
Minister of Lands.

VICTORIA, B.C., February 17th, 1919.

The Hon. T. D. Pattullo,
Minister of Lands, Victoria, B.C.

SIR,—I have the honour to submit the Annual Report of the Water Rights Branch of the Department of Lands for the year ending December 31st, 1918.

I have the honour to be,
Sir,
Your obedient servant,

E. A. CLEVELAND,
Comptroller, Water Rights Branch.

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REPORT OF THE WATER RIGHTS BRANCH.

BOARD OF INVESTIGATION REPORT.

The work of the Board of Investigation during the year ending December 31st, 1918, included the determination of rights under Acts prior to the "Water Act, 1909," riparian rights, approval of undertakings, extension of time for commencement and completion of works under water records, and Indian rights.

Meetings of the Board of Investigation have now been held in all parts of the Province and preliminary hearings in regard to all of these claims, and approximately 7,500 have been dealt with. During the year, 1,296 formal orders were issued, 569 being directions to issue licences in substitution for records and 687 being cancellations of records. Some 2,500 orders have yet to be issued, of which 600 are for rights claimed by the different Indian Agents.

Section 6 of the "Water Act, 1914, Amendment Act, 1918," extended the time when a riparian proprietor might file a claim to water to June 1st, 1920. Up to date 110 such claims have been filed. The Board will deal with these claims after June 1st, 1920.

Section 79 of the "Water Act, 1914," provides that the Board shall hear the petition for approval of undertaking and report thereon to the Minister. Fifty-nine petitions have been filed, of which thirty-eight have been granted and twenty-one are pending.

A considerable number of applications for extension of time for commencement and completion of works under water records have been made, and extensions have been granted when it could be done without affecting injuriously later licensees who had made beneficial use of the water.

A large number of claims for water rights for the use of Indians have been filed during the past year. Surveys have been made by the Department's Engineers, and the Board is in communication with the Department of Indian Affairs with a view of arranging, as soon as possible, for the hearing of the claims and adjudicating upon the rights.

I have, etc.,

J. F. Armstrong,

Chairman, Board of Investigation.

DISTRICT OFFICES REPORTS.

KAMLOOPS DISTRICT.

The irrigation season of 1918 was probably one of the worst the Department had to deal with since its inception. A late and exceptionally dry spring, in which the snow was largely lost by absorption and evaporation, was the chief source of the trouble. Streams which ordinarily give no trouble were the subject of much contention; on many streams the usual freshet-discharge was non-existent, and as a result many storage-lakes were deprived of their supply and remained almost empty for the whole of the season. With such conditions it was inevitable that difficulties should arise in the division and distribution of water. In many cases it was found necessary to make orders for rotation, automatic division, or to entirely desist from using the water. The enforcement of an order by the ordinary means was impossible in some cases owing to the lack of control due to the unsatisfactory form of headgates. It is hoped that this difficulty will be overcome in the future by the installation of headgates of suitable construction.

Your Engineer travelled close to 3,300 miles by rail, about 2,200 miles by motor, and 100 miles by other means, in the pursuit of his duties during the season.

The season's field investigations were confined mainly to the Ashcroft Water District. Besides numerous small investigations, a survey in connection with a number of applications on Ashcroft or Barnes Creek was made. Of chief interest, perhaps, to the citizens and ranchers of Ashcroft and vicinity was an investigation into the possibilities for the irrigation from the Bonaparte River of certain lands lying north of the Basque Ranch and west of the Bonaparte and Thompson Rivers. The irrigable area was found to be far smaller than estimated, and the feasibility of the scheme appears to be subject to the relinquishment to the Province by the Indian Department of a large portion of the Ashcroft Indian Reserves Nos. 1 and 2.

A new dam was built in the spring on Monte Lake, and another in the fall on Edith Lake. Both dams replace old ones that were a menace to the public, and it is satisfactory to note that it was possible to bring the parties interested to realize the necessity of complying, in their own and the public interest, with our orders.

Storage by Senator H. Bostock in the near future of the freshet-water of Monte Creek is contemplated. The site of the proposed reservoir is located in the Monte Hills Forest Reserve, and from an examination made on the ground and plans on file the project seems feasible. The lands to be irrigated from this proposed supply form a part of the Bostock Ranch at Ducks, and will bring some hundreds of acres of first-class land under cultivation.

Pumping water for irrigation by hydro-electric or gasolene engine appears to have passed the experimental stage. During the season two new electric pumping plants were put into operation—one on the South Thompson River for the Kamloops Industrial School, and the other on the Josephine Ranch on the North Thompson River. Both plants were successful, and it is reasonable to suppose that a still greater advantage will be taken of this form of irrigation in the future.

I have, etc.,

C. VARCOE, A.M.E.I.C.,

District Engineer.

OKANAGAN DISTRICT.

The past year was a very prosperous one in the Okanagan Valley, the crops having been a fair average and prices high. It is estimated that $4,000,000 worth of farm produce was shipped out of the valley last year, which is slightly greater than the total amount of capital spent on irrigation-works in the valley, and the greater part of the produce shipped was grown on irrigated land. Kelowna exported $1,100,000 of farm produce during the past year, every bit of which was grown on irrigated land.

The total capital spent on irrigation-works tributary to Kelowna is approximately $1,605,000. These figures are, I think, a conclusive answer to those pessimists who five years ago advocated the abandonment of all the irrigation systems in the Okanagan Valley and the return of the irrigated lands to their former state of cattle-ranges; especially when it is considered that all the orchards under irrigation are not in full bearing, and that there are many thousands of acres which have not been brought under cultivation.

There was no great additional quantity of land brought under cultivation and irrigation in the Okanagan Valley last year, but for the last five years there has been a small and steady increase in the area under cultivation and irrigation; the cumulative effect of which is now becoming apparent in a considerably increased draught on all the streams and irrigation systems in the valley. Also the majority of the orchards planted are now coming into bearing and require twice the amount of water that they did when first planted out. The combined result of the increase of land under cultivation and the increase in age of the orchards was that with a few exceptions there was a general shortage of water all through the Okanagan Valley last fall. With only three exceptions, the capacity of the reservoirs was not sufficient to meet the requirements of the lands they served, and many of the lands that were irrigated from streams, the flow of which had been supposed to be ample to meet the requirements of all lands adjacent, had insufficient water last fall. If any more land is to be brought under irrigation in the valley, or if even that now under irrigation is to be brought to its maximum state of productiveness, then it is imperative that the reservoir system of the valley must be largely increased, both by the construction of new reservoirs and the enlargement of existing reservoirs wherever possible.

Realizing the necessity of increased storage-reservoirs, the following companies and communities either constructed or started construction of storage-reservoirs:—

The Kelowna Irrigation Company built a crib log dam 22 feet high and 250 feet long at the outlet of South Lake, situated on the South Fork of Mill Creek. This reservoir is capable of holding 800 acre-feet.

The owners of 1,000 acres of land at Ellison, to which the waters of Scotty Creek are appurtenant, started an earth dam at the outlet of Trapper Lake, which drains into Scotty Creek. On account of the shortage of labour they only got the foundation cleared off.

At Naramata, the land-owners having arranged for a loan of $10,000 from the Conservation Fund, started construction of an earth-fill dam at the outlet of what is known as the Big Meadow on Chute Creek. On account of the lateness of the season when the work was started—last week in September—and the difficulty of getting competent labour, little progress was made in building the dam, the work done consisting of the erection of two log cabins, clearing and stumping the site, clearing off the surface dirt from the south half of the site, digging trench for outlet culvert, and laying foundations for outlet culvert. The work closed down on November 4th, there being then 1 foot of snow on the ground and hard frost at nights. The proposed dam will be 18 feet high, 627 feet long, and capable of storing 700 acre-feet of water.

At Peachland, the land-owners under the existing irrigation system having arranged for a loan of $5,000 from the Conservation Fund, started the construction of an earth dam with concrete core wall at the outlet of their present reservoir on the North Fork of Deep or Peachland Creek. The work started on October 8th and closed down on November 17th on account of snow and frost. The site for the dam had been cleared and stumped, the core wall and spillway built, and about one-third of the earth fill made when the work closed down. Three weeks to a month's work should complete this dam in the summer. The height of dam is 8 feet, length 232 feet, and should impound 250 acre-feet additional water.

Messrs. McKinnon *et al.* constructed a small reservoir on Jack Lake, which drains into Powers Creek, for the purpose of irrigating District Lot 3188. This reservoir was formed by digging an outlet drain from the lake 6 feet deep and 450 feet long, and placing a bulkhead and gate to the same, with a small crib dam on top. This reservoir should store 500 acre-feet and is capable of considerable enlargement as requirements warrant it.

D. Gellatley also constructed a small reservoir on a small lake above Jack Lake, and which drains into same, by building up an old beaver-dam and putting a gate in same. This reservoir will store about 60 acre-feet as at present.

The Summerland Municipality, I believe, increased their storage by raising some of the existing reservoir dams, and also, I believe, did a considerable amount of reconstruction-work.

The Municipality of Penticton have during the year laid 1,100 feet of 4-inch wood pipe and 2,250 feet of 6-inch pipe, or a total of 3,350 lineal feet of irrigation-pipe, to withstand a pressure of 100-foot head; replaced 1,400 feet of the old Ellis Creek main flume by a new 3- x 2-foot wooden flume, tongued and grooved, set in concrete footings. They have also replaced the old log intake on Ellis Creek by a solid concrete intake, which cuts off the seepage losses that used to take place through the old crib. Some 30,000 feet B.M. of lumber has also been used in general repair-works on the system.

The Kelowna Irrigation Company had their 32-inch steel siphon across Mill Valley scraped and painted inside last spring, at a cost of $4,450; this was a very necessary repair, as it was becoming badly corroded internally.

The same company's main distribution system supplying the Glenmore and Rutland Valleys being in need of immediate repairs, and the company not having the funds to make same, the land-owners under the two systems arranged for a loan of $20,000 from the Conservation Fund for repair-work. This work started the last week in September and closed down on November 26th on account of snow and an outbreak of Spanish influenza in the Rutland camp. The work consisted of, in Glenmore District: The relining of 1,620 lineal feet of main ditch; new bottoms in 555 lineal feet of main ditch; relining of 1,060 lineal feet of Lateral 1; relining of 510 lineal feet of Lateral 3; new bottom in 60 lineal feet of Lateral 3; or a total of 3,805 lineal feet repaired. This work was necessitated by the cracking and collapsing of the sides of the concrete ditches and the cracking and disintegration of the bottoms.

The cracking of the sides was due to two causes—the expansion of the stiff clay at the back of the concrete lining, due to moisture, also, and principally, to surface water getting behind and under the lining in the early spring during the day and freezing at night. This has completely wrecked a large part of the concrete ditches in Glenmore. Another cause which has contributed to the cracking and destruction of long lengths of ditch was the placing of a board longitudinally underneath the bottom of the ditches for the purpose of forming a cover to a stone drain laid underneath same to carry away seepage-water. This board swelled and burst up the bottom for thousands of feet. Where the ditches were built through a gravelly formation they are in a fairly good condition, though none of them are in the condition that they should be if proper material and care had been used in their construction. The concrete of which the lining of the ditches is composed is of a very porous nature and anything but watertight; on account of this there is a very great seepage loss, not only through the cracks in the ditches, which are many, but also through the concrete itself, the result being that considerable tracts of land all through the valley underneath the ditch system have become water-logged, and the trees, both pine and fruit, are dying. The injurious effects of this seepage-water may be partially overcome by subsoil drains, but the ditches themselves should be relined when badly cracked and coated with a water-proofing material such as pitch or asphaltan.

As a large part of the company's Rutland main ditch system is formed of wooden flumes, which were in a poor state of repair and leaking very badly, but not so badly dilapidated as to necessitate rebuilding, 4,500 lineal feet of flume in this ditch were lined last fall with a layer of tar-felt covered with ½-inch boards. The company's chief bailiff had tried this on several lengths of flume the year before and found it satisfactory. It will stop the great loss of water through leakage and prolong the life of the flume four or five years at least.

The Canyon Creek Irrigation Company replaced 2,960 lineal feet of distribution-flumes by new flumes, strengthened and repaired the dam at their Reservoir A on Canyon Creek, installed measuring-boxes on their distribution system, and did a considerable amount of general repair-work.

I have, etc.,

F. W. GROVES, M.E.I.C.,

District Engineer.

GENERAL REPORTS, ETC.

HEAD OFFICE GENERAL WORK.

STAFF.

The number on the staff remains about the same, being twenty in December, 1918, compared with eighteen reported for the previous year. In order to cope with the pressure of field-work during the year the services of four of the men in the draughting-room were utilized for varying lengths of time.

Mention must be made of the death from influenza of H. G. Lawley, Assistant Engineer in the Nelson District, who had rendered for some years faithful and efficient service to the Department.

APPLICATIONS, ETC.

On receipt of an application it is entered on the water-rights map or reference map and a note made of any further information required, on receipt of which the conditional licence or authorization is issued.

The number dealt with during the year is as follows: Applications received, 212; conditional licences issued, 245; final licences issued, 15; authorizations issued, 9; applications withdrawn, lapsed, or cancelled, 188.

In connection with the reallocation of space in the vault, one of the Engineers was deputed to represent this Branch; the files were carefully looked through and rearranged systematically, and about 1,200 that were closed and dealt with matters not likely to be raised again were removed to save time and space in locating current files.

The checking of plans for Class "C" licences, preparation of several reports on power possibilities in various parts of the Province, compiling and revising lists of the rights on special streams, and of all rainfall stations and waterworks in British Columbia, and calculations of discharge of water over weirs, through pipes and openings under different conditions of slope and head, have formed a good part of the year's work.

REVENUE FOR YEAR ENDING DECEMBER 31ST, 1918.

Purpose.	Application Fees.	Rentals.	Total.
1. Power	$1,343 50	$ 7,365 05	$ 8,708 55
2. Irrigation	726 59	3,992 38	4,718 97
3. Miscellaneous	56 50	1,107 67	1,164 17
4. Mining	376 85	5,070 20	5,447 05
5. Clearing-streams	.....	400 03	400 03
6. Storage	26 00	544 30	570 30
7. Waterworks	400 35	512 38	912 73
8. Steam	83 65	182 75	266 40
9. Domestic	129 35	214 05	343 40
10. Fluming	25 00	35 15	60 15
11. Lowering-water	5 00	.....	5 00
12. Hydraulicking	.....	.....	.....
13. Conveying	.....	.....	.....
14. Mineral-trading	.....	10 00	10 00
15. Certificates of approval	125 00	.....	125 00
Totals	$3,297 79	$19,433 96	$22,731 75

COMMISSION INVESTIGATING IRRIGATION COMPANIES.

J. S. T. Alexander, E. Davis, and F. H. Kidd, who were appointed as a Commission under the provisions of section 171 of the "Water Act," as amended in 1917 and 1918, report as follows:—

"By Order in Council No. 1300 we were appointed to examine and report upon the financial condition of the Canyon Creek Irrigation Company, Limited, the general condition of its water system, and its ability to fulfil its obligations to persons using water from its works.

"On January 16th, 1918, we proceeded to Kelowna, where we examined the books and inspected the works of the company and took the evidence of numerous water-users and representatives of the company.

"By Order in Council No. 1615, approved on April 9th, 1918, we were appointed to make similar investigations of the affairs of the Kaleden Irrigation and Power Company, Limited. The books of this company were in the custody of its secretary in Vernon, where Mr. Kidd examined them. While he was so engaged Mr. Davis inspected the company's works from the intake on Sheep Creek to the lands at Kaleden where the water is used. On April 19th we all met at Penticton and the next day proceeded to Kaleden, where we heard the evidence of the water-users there. On the 20th, at Penticton, we took the evidence of Mr. Latimer, the engineer who laid out the works and subdivided the lands at Kaleden, and of J. M. Ritchie, the managing director of the Kaleden Irrigation and Power Company, Limited.

"By Orders in Council Nos. 2091 and 2260, approved July 22nd, 1918, and September 6th, respectively, Mr. Davis, Mr. Roberts, and Mr. Alexander were appointed to investigate the affairs of the Kelowna Irrigation Company, Limited; the Central Okanagan Land and Orchard Company, Limited; and the Central Okanagan Lands, Limited, under the section of the 'Water Act' above referred to. On September 18th and 19th, in Kelowna, we met and examined many of those using water from the Glenmore part of the Kelowna Irrigation Company's works, and in the evening of the 20th we went to Rutland school-house, where we secured further information concerning the Irrigation Company's affairs, more particularly with respect to the irrigation of lands in the Rutland Subdivision.

"The Kelowna Irrigation Company and the Central Okanagan Lands, Limited, being in the hands of a receiver whose office is in Vancouver, Mr. Roberts spent some days there and made a thorough examination of their books. He also examined the books of the Central Okanagan Land and Orchard Company which were produced by the officers of that company.

"Reports on all these companies have been compiled by us and submitted to His Honour the Lieutenant-Governor in Council."

IRRIGATION.

VERNON.

In view of the fact that during the past few seasons there was a shortage of water under the White Valley and Coldstream Internal irrigation systems, representations were made to the Department to make an investigation as to what extent the water-supplies could be augmented. It is very evident that if the water-supply is at present deficient for the land under irrigation it will be more so in the future when more land is using water. In view of the fact that the continued operation of the White Valley system is dependent on an increase in its revenue, it is of vital necessity that more water be available.

Accordingly, J. F. Rowlands, A.M.E.I.C., was detailed to undertake the work. His report is as follows:—

"White Valley Irrigation and Power Co's Water-supply.

"Work in connection with the above was commenced in September. A general investigation of the headwaters of Jones Creek was made; each branch of the stream was examined for discharge and relative storage value. The time available was not sufficient to complete the field-work, and a number of reservoir-sites are not yet surveyed or cross-sectioned. The figures given are subject to reasonable adjustment upon completion of the surveys. The matter of costs cannot be considered at this stage, and is deferred until the field-work is finished and the whole system and scheme ready for consideration, including the proposed supplementary supply from Harris Creek.

"*Jones Creek.*—A high percentage of the total water discharged comes through two branches of the creek, viz.: (1) The East Fork, flowing through Aberdeen Lake; (2) the South Fork, which drains the Grizzly hills.

"The East Fork drains some 14,000 acres behind the dam at Aberdeen Lake and a mean annual discharge of 8,000 acre-feet of water can be developed. Storage accommodation for this amount can be developed by raising the existing dam 5 feet and replacing the present culverts by one at a 2-foot lower level. The dam is in a dangerous condition and in need of considerable repair, including culverts; when the latter are opened up the construction at a lower level should be carried out.

"The South Fork, including Haddo Lake, drains some 15,000 acres and the mean annual discharge is estimated at 8,500 acre-feet of water. A dam at the outlet of Haddo Lake would pen back about 1,500 acre-feet of this; it is not established that the other sites available are large enough to store the remaining volume. There are large swamps about a mile above Haddo Lake that may hold a considerable portion of it, and these are the most important of the unsurveyed sites, having an extensive drainage area behind them.

"*Fish Lakes.*—As reservoirs, these lakes are not suited to the conditions, their areas being too large in proportion to the volume of water available for storage, resulting in a very high percentage of loss through evaporation; also their outlets are unfavourable. There is a suitable site for a dam on Fish Creek situated at the outlet of a large swamp and meadow about three-quarters of a mile from its junction with the main stream. A survey of and capacity of this site is required. It is estimated that 500 acre-feet of water will be available for storage at this point. This will include the Fish Lakes drainage.

"Mud Creek and Summit Creek are small freshet streams discharging together about 500 acre-feet of water annually. There are small swamps on both creeks that will probably hold this amount; the outlets are suitable for dams; these sites are not yet surveyed. The large Summit Lake is not suitable for a reservoir, for the reasons applied to Fish Lakes.

"Referring in general to Jones Creek and its tributaries, an unusually high percentage of the total discharge is available for storage owing to the reservoir-site on each branch being located near its mouth, thus making practically the whole drainage area effective and subject to control. It will be noted that the estimated mean discharge available for storage—viz., 17,500 acre-feet—is high when compared with observations of the total discharge taken at the company's weir and headgates, the seven-year mean of which is 19,000 acre-feet, covering a four-months' recording period annually. From examination of the weir where the records are taken, a high velocity of approach is suspected, which during the high run of the creek would considerably increase the calculated discharge; further, a four-months' period does not approximately represent the total discharge of this stream. In support of this statement it was observed that the two main branches of the creek were discharging a considerable volume of water last September and October.

"*Harris Creek.*—To obtain information upon the feasibility of bringing water from Harris Creek to supplement the Jones Creek supply, a preliminary ditch-location line was run, commencing at the White Valley headgate. The point of diversion on Harris Creek would be approximately eight miles on grade from the headgates on Jones Creek. For about 75 per cent. of this distance the conditions are favourable for ditching; the remaining portion could be flumed.

"The first mile in the Harris Creek Canyon is on a steep rocky side-hill, part rock-slide. Owing to shortness of time available only work of a preliminary nature was attempted; the investigation should be continued in detail and a close location and estimate of cost made. Unfortunately no discharge records of Harris Creek are available, but it appears to be a larger stream than Jones Creek. Nothing is known of the drainage area. An extension of the photo-topographical survey (Surveys Branch) to include Harris Creek would be of great assistance to the Water Branch, as ultimately this stream will figure prominently in irrigation adjustments in this district.

"*Deer Creek.*—Deer Creek is the source of the water-supply for that portion of the Coldstream Estate irrigated from the King Edward ditch. An investigation of its watershed has been made and the maximum storage possibilities ascertained. King Edward Lake is the only storage-site on the stream of any importance. A chain of swamps and a small lake about 15 acres in area, situated within the King Edward Lake catchment, are of no consequence,

inasmuch as the main site fully developed will provide storage for all the water available. The area draining into King Edward Lake is about 1,600 acres. The mean annual run-off from this area is estimated to be 1,000 acre-feet.

"The capacity of the existing reservoir is 860 acre-feet. By drawing the water off at a level 2 feet lower than the present outlet and raising the dam 2 feet the storage capacity is increased to 1,100 acre-feet."

ASHCROFT.

A petition was filed with the Department by a number of land-owners near Ashcroft, requesting that a survey and report be made as to the feasibility and practicability of irrigating certain lands from the Bonaparte River. A. G. Hatton, acting under instructions from District Engineer Varcoe, undertook the surveys required. The substance of the report is as follows:—

"It has been assumed locally that the Semlin Valley could be supplied from the Bonaparte River, but the following figures prove to the contrary:—

Place.	Elevation.
Boston Flat ditch near Cache Creek	0
Bridge over Bonaparte River at Cache Creek	—98
Bridge over Cache Creek to Parke's Ranch	—42
Ground-level, south-west corner of Lot 3, Group 2	+209
Western Canada Ranching Company's ditch from Cache Creek	+256
Ground-level, north-east corner of Sections 20, 21, and 24	+274

"Another local assumption has been that it is possible to divert Hihium Creek directly into a branch of Cache Creek.

"The investigations indicate that it would not be possible to divert water from this source directly into Cache Creek. Hihium Creek is a very sluggish stream and meanders through wild hay meadows, for the first two or three miles of its course having practically no fall, while the country at the east end of the lake falls towards Deadman's Creek, the physical nature of the land being such as to make a diversion from this direction to Cache Creek out of the question.

"It being impracticable to include the Semlin Valley in a project taking water from the Bonaparte River, we directed our attention to a determination of the irrigable area of the lands on the western side of the river. The result of the survey was disappointing, so much so that instead of running a grade-line for a ditch as at first intended, it was decided to obtain some approximate data upon which rough figures as to probable cost might be based. For this purpose a tie for elevation was made on the old Boston Flat ditch; although this ditch was a failure, it actually carried water to a certain point, but in insufficient quantities. The ditch was found to be 66 feet lower than the control-point on the lands under the project, and it was assumed that a ditch to supply the lands would take its point of diversion at least 66 feet higher than the Boston Flat intake plus the additional head for grade. From levels taken above the proposed intake a rise of 77 feet was found in a distance of about three miles, and it indicates that it would be necessary to go from 5 to 6 miles above the said point to obtain the required grade, making the ditch-line, including about six miles of flume, about nineteen miles in length. It is believed that this is a sufficient guide in determining the advisability of further investigations or the contrary."

GRAND FORKS.

During the latter part of 1917 and a short time in 1918 preliminary surveys were made to determine the feasibility and practicability of irrigating certain lands in the vicinity of Grand Forks either by pumping or gravity systems. From the investigations made it would appear that it is not feasible to obtain a gravity supply from the North Fork of the Kettle River, and that it is necessary to make a diversion from the main Kettle River at a point approximately seven miles south of the boundary. Owing to the difficult nature of the ground through which the conduit would pass, further investigations are to be made so that the estimated cost may be determined.

CRESTON.

A petition was filed relative to the construction of an irrigation system near Creston. The late H. G. Lawley, assistant to District Engineer Biker, commenced the surveys for this scheme,

but unfortunately, owing to his contracting Spanish influenza and his subsequent death thereby, the work was not finished. It is the intention to proceed with this work at an early opportunity.

Keremeos.

In view of the fact that there is a large area of bench land near Keremeos which could be irrigated from an extension of the Keremeos Land Company's irrigation system, C. A. E. Shaw was employed to make a report on the feasibility and probable cost. The substance of his report is as follows:—

"A survey was made for an irrigation-ditch from the end of the Keremeos Land Company's ditch at Keremeos to the north boundary of the Similkameen Fruit Land Company's property. From this point, with the exception of a few acres at the north-east corner of the latter company's land which can be irrigated from Barcelo Creek, the water can be taken to any part of the property to be irrigated.

"The ditch would be about three miles and three-quarters in length, and by careful location all but a few hundred feet of this can be made in ditch. A flume would be required at the crossing of Keremeos Creek, one or two short flumes at Stations 151 to 160, and a flume or siphon about 700 feet in length at Stations 167-174. Several other short flumes would also be required.

"A rough estimate of the cost would be about $7,000—say, $4,500 for excavation, $1,500 for rock-work and boulders, and $1,000 for fluming. This is exclusive of the cost of right-of-way, which would probably be expensive up to Station 70, especially if the ditch crosses the road to the north side, as most of the land is planted in orchard, and it might be necessary for this reason to carry the water through part of this distance in underground pipes.

"There are at present about 800 acres under irrigation supplied from the Keremeos Land Company's system, and this system would have to be enlarged, as an additional 800 acres would require water.

"Keremeos Creek cannot be relied upon as a sole source of supply. There are, however, one or two reservoir-sites on the watershed which might be developed to advantage, although there is no definite data at present; this can be obtained by sending out a survey party during the 1919 season.

"Ashnola Creek would have to be relied upon for the major part of the water-supply, and consequently the Keremeos Land Company's system would have to be enlarged to carry this water."

Conservation Fund.

Owing to the shortage of water under a number of irrigation systems in the Okanagan Valley, it has been necessary for the Government to come to the assistance of the water-users. For this purpose a fund called the Conservation Fund has been set aside, and the moneys spent therefrom are to be a first charge against the assets of the companies operating the systems and against the lands which are served by the systems. The works contemplated or being constructed are as follows:—

Project No. 1—Storage-dam at Big Meadow for the system at Naramata.

Project No. 2—Raising the dam at North Fork, Peachland, to increase the storage.

Project No. 3—The drainage of three sloughs in the vicinity of Rutland. Owing to the rise in the water-table of some lands, due to irrigation, this work is very necessary.

Project No. 4—The repairs to the irrigation system of the Kelowna Irrigation Company.

Project No. 5—The construction of a system of flumes at Scotty Creek near Kelowna to replace ditches, thereby conserving the water-supply.

Project No. 6—The repairs to the White Valley Irrigation and Power Company's system at Vernon.

The work on Project No. 1 at Naramata was commenced on September 28th and continued until November 4th, when owing to the frost and snow it was not economical to continue. The storage of water to furnish an adequate supply to the land being served by the Naramata system is an expensive undertaking, as there are no reservoir-sites of any large size available, and what there are require expensive dams. It was suggested that Chute Lake be used as a reservoir, but owing to the location of the grade of the Kettle Valley Railroad it is impossible to store more than 400 acre-feet of water at this site. This alone precluded utilizing same, although the use

of this water would have necessitated a long conduit from Chute Creek to connect to the present system, and, further, it would prevent the lands nearer Chute Creek from being developed.

The site at which the dam is being erected is known locally as Big Meadow. The capacity of the site is as follows:—

Elevation of Contour.	Area of Contour in Acres.	Contents between Contours in Acre-feet.	Accumulated Contents of Contours in Acre-feet.
5,280 feet (0)	32.1	....	....
5,285 „ (5)	40.8	182	182
5,290 „ (10)	56.8	243	425
5,295 „ (15)	69.5	316	741
5,300 „ (20)	79.8	373	1,114
5,305 „ (25)	89.2	422	1,536

The catchment area above the dam-site is approximately 2½ square miles (1,600 acres), and assuming that the average precipitation over this area is 20 inches per annum, there should be a total of 2,660 acre-feet of water fall upon the 1,600 acres. Allowing 25 per cent. of this water as the estimated run-off, there should be approximately 930 acre-feet available for storage. The dam is at present being constructed up to an elevation of 18 feet and should be capable of storing 700 acre-feet of water.

The work on Project No. 2 at Peachland was not commenced until October 8th. It consisted of increasing the height of the existing dam 6 feet. The dam as originally constructed had a concrete core wall; this raised the 6 feet and as completed is 217 feet long. A concrete and stone spillway 20 feet wide was provided at the south end of the wall. An earth fill 8 feet wide on top on each side was brought up to within 2 feet of the top of the wall. It is estimated that 50 per cent. of the earth fill is in place. The channel of the stream below the culvert outlet was cleaned out and deepened for a length of some 200 feet.

This reservoir is situated on what is locally known as the North Fork of Peachland Creek (Deep Creek). The catchment area is four square miles and the capacity of the reservoir before the commencement of the work this past season was 531 acre-feet. This has been increased to 850 acre-feet by the new work. The contents of the site are as follows:—

Elevation of Contour.	Area of Contour in Acres.	Contents between Contours in Acre-feet.	Accumulated Contents of Contours in Acre-feet.
0.00	48.87	.....	Sill of outlet.
5 feet	52.95	254.55	254.55
10 „	60.02	282.40	536.95
15 „	65.87	314.70	851.65
20 „	72.15	345.05	1,196.70

From the data available there should be at least 1,000 acre-feet of water run-off from this watershed above the reservoir-site.

Work in connection with Project No. 3 has only just commenced, owing to the fact that the organization of the Rutland Drainage District was incomplete. As it will take some time before all the requirements of the "Drainage, Dyking, and Development Act" are complete, it was decided that the construction of the main drainage-ditch should be undertaken before the water-table rises, due to the spring run-off, thereby saving considerable extra work. Preparations are now under way to undertake the work.

Work on Project No. 4, being the repairs to the Kelowna irrigation system, was commenced on September 26th and continued until November 26th. During this time a total length of 3,805 feet of concrete ditch was either fully or partially relined in the Glenmore section of the system, while a total of 3,500 feet of wood flume was lined with tar-felt and lumber in the Rutland section of the system.

No work has been undertaken on Project No. 5 up to the present, as the farmers were too busy in the fall to take up the matter of construction or organization of their district. Directly the district is properly incorporated it will be possible to proceed with the works.

The work on Project No.-6 was carried out by the White Valley Irrigation and Power Company, and consisted of making necessary repairs and improvements to the system.

WATER-POWER.

In view of the development of the pulp and paper and other industries, it is very desirable that water-power investigations be carried further, as upon reports of this nature will depend very largely whether capital can be interested or not. The Commission of Conservation had several survey parties in the field a few years ago, but their operations consisted in merely locating a possible power-site, ascertaining the probable head, and making measurements of the stream-flow while in the vicinity. What is now desirable is to follow up these preliminary reports by ascertaining the character and boundaries of the watersheds and establishing stream-gauging stations. The lack of this information has resulted in more failures of power developments than any other cause.

The report of W. Blane on the power possibilities on Queen Charlotte Islands which he carried out during the summer of 1918 is as follows:—

"Ain River.

"*Source.*—The Ain River, flowing into Masset Inlet at Indian Reserve No. 6, about two miles north-east of Buckley Bay sawmill, is the outlet of a chain of lakes on the north side of Masset Inlet. Of these lakes the largest is Ian, having an area of 5,400 acres or 8.4 square miles; it is connected by a channel half a mile in length with Skundale Lake, the area of which is 320 acres or 0.5 square mile. The fall from the large to the smaller lake is less than a foot in the half-mile. From Skundale Lake another channel of about two miles in length, both channels being navigable by canoe or light-draught boat, leads into Ain, the smallest lake of the series, the area of which is about 200 acres. The fall between these two latter lakes is about 4 feet.

"From Ain Lake the Ain River flows in a winding channel in a general south-easterly direction to Masset Inlet; the difference in elevation between mean low water of Ain Lake and mean high-tide level of Masset Inlet being 124 feet.

"*Drainage Area.*—The drainage area covers approximately 98,800 acres or 155 square miles of territory. This is mountainous and heavily wooded over the greater portion, the exceptions being the higher mountain-sides, which are bare, and occasional stretches of open muskeg. There is also in many places a dense undergrowth of salal, whilst spagnum and other mosses abound, making ideal natural conditions for a gradual and economical precipitation run-off.

"The precipitation data used is taken from the Meterological Report for 1916-17 of Masset Station, covering an observation period of seventeen years, with an allowance of 8 inches per year increase, due to local conditions, as the Ian Lake neighbourhood, owing to its mountainous character, is said to average greater annual precipitation than the country in the vicinity of Masset.

"The precipitation at Masset, according to said Meterological Report, is 52 inches, and allowing an increase of 8 for local difference, this would give to Ain Lake and vicinity a precipitation of 60 inches.

"This applied to the drainage area in question will give a total precipitation of 494,000 acre-feet, or sufficient to produce a run-off of 550 feet per second, allowing that 14 per cent. is taken up in evaporation and 6 per cent. in plant-structure.

"*Characteristics of River.*—The river may be said to be divided into two parts—the first beginning at Ain Lake and terminating at the West Fork of the river, and the second beginning at the West Fork and terminating at Masset Inlet.

"The first part, from Ain Lake to the West Fork, covers a distance of a little less than a mile. In this distance occurs 105 feet of the total 124 feet of fall between the low-water level of Ain Lake and mean high tide of Masset Inlet. For this portion of the river the banks are in general high, the bed is of rock of very uneven surface, and low falls are of frequent occurrence.

"The second part of the river, that is from the West Fork to tide-water, although of considerably greater length than the first part, has much less fall, and in consequence a slower flow, whilst the banks have flattened out to a considerable extent.

"The average width of the river throughout is about 60 feet and the average central depth probably 2 feet, but the river-bed is so uneven and full of rock pockets that it is difficult to determine an average uniform depth.

"*Volume.*—Several gaugings made on the river between the proposed dam-site and the entrance to the lake gave a mean of 317 cubic feet per second. This may be regarded as mean low discharge.

"Gaugings were also taken at the same place in August, 1917, by E. A. Cleveland, of Vancouver, who had installed here an automatic water register. The foundation for this instrument he built of such a height as to ensure that the instrument itself would be above the reach of the highest flood. In deciding on this high-water mark he had been guided by local information covering a number of years, and also by erosion and other water-marks along the bank; however, in November, 1917, the waters of the lake rose to an unusual height, completely covering the water register. When this flood stage was at its height a durable mark recording the elevation was made on a tree close to the guaging-station. In August, 1918, at the time of extreme low water in Ain Lake, a measurement was made from extreme low-water mark to this mark on the tree, and the difference was found to be 11 feet.

"Using the same stream velocity as before, also the same cross-section for the bed of the stream, but with the additional 11 feet of water, the flow would be augmented by 3,850 cubic feet per second or a total extreme high-water flow of approximately 4,200 cubic feet per second.

"*Storage.*—The natural storage-basin of Ian Lake, about 10 square miles, will yield a minimum low-water flow of 317 cubic feet per second, or a maximum flow of approximately 4,200 cubic feet per second under exceptionally favourable high-water conditions. This storage area may, however, be increased by the erection of a dam of such a height (maximum height being under 50 feet) as would provide storage for the whole precipitation run-off from the entire catchment-basin, and the flow could be so regulated from the reservoir as to permit of a continuous discharge of 550 cubic feet per second.

"*Dam-site.*—This site is in Ain River at the first falls, about 200 feet from the entrance to the lake. The channel at this point contracts between rock walls and is about 36 feet wide at low water. The bed of the river is also of rock, all basaltic in character. The wall on the east side rises to a height of 50 feet in a horizontal distance of 60 feet; on the west side to a height of 50 feet in a horizontal distance of 80 feet, with in places a surface covering of several feet of moss and earth.

"*Mill-site.*—To procure a suitable mill-site at tide-water where freight and other boats could make a landing it would be necessary to go about three-quarters of a mile from the river's mouth, as a long sand-bar extends past the entrance to the river and in front of the Indian reserve, rendering navigation there impossible, except to small boats. The nearest site of this description obtainable is near the south-east corner of Lot 1437. From here a narrow-gauge railway or motor-truck road-bed could be built on a direct line to the West Fork of the river, from which point there would be a heavy grade to overcome, which might the easier be accomplished if the course from here on followed the windings of the river.

"If such a railway were built in order to take in the materials necessary for building a dam, a great part of its cost might be defrayed by bringing out such spruce and other millable timber as might be in proximity to such railway.

"*Power.*—Considering the available head as 124 feet and the continuous flow under reservoir government 550 cubic feet per second, the available horse-power is 6,200 (using an efficiency factor of 80 per cent.).

"AWUN RIVER.

"*Source.*—Awun River is the outlet of Awun Lake and flows north into Awun Bay near the western end of Masset Inlet.

"*Characteristics.*—The river is about one mile in length from the lake to a point where it meets the high tides from the inlet; from this point to the mouth is about a quarter of a mile, or in all a total length of a mile and a quarter. The banks in general are sloping, but in many cases rise abruptly to a height of 10 or 15 feet. The channel has a well-defined low-water bed, but there is every evidence that it has cut for itself auxiliary channels during flood stages.

"The average velocity of the low-water flow is about a mile and a third per hour as found by timing floats in a representative reach of the stream, the average width about 30 feet, and

the average central depth 1¼ feet. Two falls occur, one of about 5 feet at a point about two-thirds of the distance up the river from tide-water; the other about 2½ feet at the point chosen for a dam-site.

"*Volume.*—Gaugings gave a mean of 60 cubic feet per second, which might be considered as slightly more than the low-water discharge. This discharge would not seem to be very constant, as the mountains surrounding the lake rise with a steep incline and in many places are partly denuded of vegetation through the action of slides. The influence of precipitation would therefore be felt quickly and the flow of the river on that account be rendered irregular.

"*Drainage Area.*—The drainage area comprises nearly twenty square miles, of a rugged mountainous character, showing frequent rock-outcrops, but heavily timbered on the lower slopes.

"The precipitation here is assumed to be equal to that of the Ian Lake neighbourhood and taken as 60 inches. Therefore, with an annual precipitation of 60 inches and a drainage area of twenty square miles, there will be a total annual precipitation of 64,000 acre-feet, and allowing loss by evaporation to be 14 per cent. and from other causes 6 per cent., there is available 52,200 acre-feet, or sufficient to produce a continuous flow of 72 cubic feet per second.

"*Levels.*—The elevation of Awun Lake above high-tide levels of Masset Inlet is 48 feet.

"*Power.*—Considering the available head at the dam to be 47 feet and the continuous flow under reservoir control to be 72 cubic feet per second, the available horse-power is 308 (using an efficiency factor of 80 per cent.). The low-water horse-power without reservoir conditions is 256.

"*Storage.*—The natural storage-basin of Awun Lake is slightly in excess of two square miles and will yield a low-water flow of nearly 60 cubic feet per second, which may easily be increased to the maximum of 72 cubic feet per second by the erection of a dam (of a maximum height of 20 feet).

"*Dam-site.*—Several dam-sites are available near the lake, but the one deemed the most suitable is at a point about 600 feet from the lake; here the drainage area divide crosses the river, sloping to the north and west respectively. At this point the river-bed is about 30 feet wide, with a fall over rock of about 2½ feet. The banks on the east side rise on a 1-to-1 slope to about 60 feet; showing frequent rock-outcrops. On the west the slope is more gradual and the banks rise to a greater height, with a considerable thickness of earth over the underlying rock.

"*Mill-site.*—A suitable mill-site could be had at the mouth of the river on the west bank; at low tide the water here is shallow and would necessitate a wharf, exceeding perhaps 600 feet in length to reach the deep water. The bay, however, is sheltered and affords a safe anchorage for small boats.

"*Power.*—The low-water flow of the river is in the neighbourhood of 60 cubic feet per second, and (using an efficiency factor of 80 per cent.) would provide 256 horse-power; but with storage facilities this could be increased to 72 cubic feet per second or 308 horse-power.

"The prospects here throughout seem more suited for a cannery than for any other industrial enterprise.

"*Lands affected by a 20-foot Dam—*

	Acres.
Lot 1088	160
„ 1086	100
„ 1084	160
„ 1082	80
„ 1080	80
„ 1079	50
„ 1081	5
„ 1083	5
„ 1546	10
Approximate total area that would be flooded	650

"MAYER LAKE.

"Mayer Lake is situated about five miles and a half east of Port Clements, Masset Inlet. It lies almost due north and south and is about seven miles and a half long with a greatest width of half a mile, and, lying as it does in a very shallow depression, does not appear to have a great depth in any part. A stream about 20 feet wide enters at the northern end; this stream

has no perceptible current, being more of a slough in character, and drains from the swampy land lying to the north of the lake.

"The outlet, Mayer River, is at the southern end, but has become blocked by an accumulation of drift, fallen trees, and silt, through which the water filters sluggishly to the more open stream-bed below. On account of these obstructions in the river and because of its very low banks, much of the high-water flow, which would otherwise be carried away by this agency, floods out over the low lands to the south, making travel in those parts difficult and cultivation impracticable.

"*Access to Lake.*—Some years ago a road was laid out from the village of Port Clements to the lake. This road runs through Lots 1883, 414, 412, 411, 391, and from thence follows the northerly boundary-line of Lots 384 and 383 to the lake. It is now seldom used, as the pre-emptors whom it was built to serve have abandoned their holdings; some did so prior to the outbreak of the present war; the others since, most of them enlisting.

"*Elevation.*—The elevation of the lake is 60 feet above high-tide water. This occurs in a distance of about nine miles following the course of Mayer River.

"*Storage.*—No natural facilities for the erecting of a reservoir present themselves here, nor would the head available justify any extensive works with a view to developing power from this source."

WATERWORKS.

ELKO.

The Elko waterworks has now been in operation some years, but owing to the town not developing as expected the revenue from the water system under the then existing rates was not enough to meet the operating expenses and the liability against the system. Through the services of the Department a new tariff was established and new officers placed in charge.

NAKUSP.

An attempt is being made to provide a water service to the residents and farmers in the vicinity of Nakusp. Early in the year a preliminary report was made by our District Engineer's office at Nelson as to the practicability and feasibility of the proposed scheme. This report outlined the possibility of providing a water service to eighty-nine taps at a cost of $26,000; allowing for repayment of the capital, depreciation, maintenance, and operation, it would be necessary to charge about $50 per annum for each tap. In view of the scattered positions of the residences, the length of pipe-line between each connection is large and greatly adds to the cost of the scheme. Even if the cost were $75 per annum for each connection it would not be excessive under the circumstances.

SIDNEY.

A reconnaissance survey was made by G. Anderson, M.Inst.C.E., during the season to determine whether it was advisable to make detail surveys as to the augmentation of the water-supply to the Sidney water system. The report discloses that there are some small reservoir-sites available, but it would appear that the cost of utilizing same might be excessive in view of the long distance the water would have to be carried before it could be made available in the existing water system.

WELL-DRILLING.

Well-drilling has again been carried on at two places in the Province during the past year—in the Hazelton Water District near Kitwanga, on the Grand Trunk Pacific Railway, about twenty-five miles west of Hazelton, and at Marysville, in the Cranbrook Water District. As stated in the last annual report, the difficulties encountered in drilling have prevented rapid progress with the operations.

Kitwanga, Prince Rupert District.

This well has been sunk on the first bench on the north side of the Skeena River, at an elevation of 104 feet above the river and 525 feet above sea-level. Owing to the difficulty of getting an experienced driller and also to the difficulty of getting well-casing, it was late in the year before operations commenced. The report of H. C. Fritts, the driller, is as follows:—

"On October 16th drilling operations were commenced and it was found that soft blue clay and sand had filled up 30 feet in the 6-inch pipe. The 6-inch pipe was then driven 3 feet in an endeavour to shut off this caving; this was not successful, and owing to the lateness of the season 4-inch pipe was used, as more rapid time could be made in drilling. At a depth of 309 feet the 4-inch pipe had shut off the caving, and I drilled past the 4-inch pipe to a depth of 350 feet in hard blue clay, where a strata of coarse grey sand was encountered that filled up in the 4-inch pipe to 253 feet from the surface. This sand, I believe, contains a sufficient amount of water for farm use, but is held back by the volume of sand in the 4-inch pipe. At this time drilling operations were discontinued owing to the number of deaths and sickness in vicinity; only for this and the lateness of the year in getting started the well would have been finished this year.

"In continuing the well, I would advise that a 20-foot length of 4-inch galvanized pipe, perforated and wrapped with fine galvanized wire screen and wire, soldered, be used in the bottom of the 4-inch pipe, and that the 6-inch pipe be drawn; also that proper equipment and tools be purchased for drawing 4-inch and 6-inch pipe, which can again be used in different wells at considerably less expense to the farmer and the Government."

The work this season demonstrated that water was available and that very little requires to be done to finish off the well.

Marysville, East Kootenay.

The operations at this point suffered considerably through the inexperience of the drillers. It is impossible to make much progress without thoroughly experienced men, and this season's work at this point more than fully bore out this contention.

DRAINAGE.

Kootenay Flats.

In order to make a closer study of the regimen of the Kootenay River it was necessary to undertake certain surveys during the season. E. P. McKie, A.M.E.I.C., was detailed to undertake this work, and his report on the work done is as follows:—

"The party consisted of two chainmen, a launch engineer, and myself. We left Nelson by launch on September 28th and arrived at Kootenay Landing on Sunday, September 29th; then proceeded about three miles up the river and fixed our first camp.

"A decision was arrived at to take a few soundings at the mouth of the river and soundings across the river at every mile. The distance of Kootenay Landing from the International Boundary at Porthill is about twenty-eight miles, but the least distance that would have to be levelled, including check-levels, cross-sections, and tieing into Dominion bench-marks, is about seventy miles.

"The method of procedure was as follows: The mile points were fixed from positions shown on the plan from what land-marks were available. A tag-line was prepared by using a ⅝-inch Manila rope and inserting tags at every 20 feet. The launch engineer and a chainman then drove in long plugs at the water-level on each bank, marking the water-level with a nail; the tag-line was stretched across the river by means of block and tackle, and the men read the depth of soundings at each tag by means of a light steel sounding-cable. After taking a sounding a trail was cut through the brush on the river-bank to the open flats, the depth of the brush varying from 100 feet to 600 feet. When soundings had been taken at three or four sections the cross-sections were completed by levels tied into the bench-marks. At Mile 18 a line of check-levels was run to Creston.

"The work proceeded in this manner until Porthill was reached on November 19th and the levels tied into the Dominion levels at the International Boundary. Owing to wet weather only about one-half of the time was available for work, and the freeze-up came the day after finishing.

"There is evidently very little difference between the elevation of the water-surface at low water at Porthill and at the lake; this is very important and should be checked, and more time should be available to run the levels than there was last fall."

GLEN LAKE, NEAR COLWOOD, V.I.

The drainage of certain lands in the vicinity of Colwood necessitated investigations as to the possibility of relieving these lands of their excess waters. E. G. Marriott, A.M.E.I.C., has made a short study of this problem, but before coming to any definite conclusion it will be necessary to do a certain amount of levelling. When this is undertaken it will be probable that a drainage district will be incorporated to undertake this work on a proper scale.

DATUM-PLANES.

The establishing of definite figures correlating the various datums in use on the Lower Mainland has made further progress, and we are indebted to A. J. Dalzell, of the City Engineer's Office, Vancouver, for the final figures relating to this important subject. The table given herewith has been submitted to Dr. Dawson at Ottawa for confirmation and may now be taken as correct:—

British Columbia Mainland Datum-planes.

Datum-planes referred to Vancouver Harbour Tide-levels.	O.L.W.		M.S.L.		H.W.L.	
	Plus Feet.	Minus Feet.	Plus Feet.	Minus Feet.	Plus Feet.	Minus Feet.
Admiralty datum (O.L.W.)	Zero.	Zero.	..	8.03	..	13.00
Mean sea-level (M.S.L.)	8.03	..	Zero.	Zero.	..	4.97
High-water level (average of higher high water)	13.00	..	4.97	..	Zero.	Zero.
Datum of Canadian Pacific Railway Co.	..	84.77	..	92.80	..	97.77
Datum, City of Vancouver	..	83.52	..	91.55	..	96.52
Datum, City of New Westminster	16.75	..	8.72	..	3.75	..
Datum, Provincial Water Dept., Fraser River	..	0.70	..	8.73	..	13.70

METEOROLOGICAL REPORT, 1917-18.

Work during the year has been continuous along the lines adopted formerly. The co-operation between the Dominion Meteorological Service and the Provincial Water Rights Branch, which was begun in 1915, has been continued throughout the year. As the result of this, records are now available from 245 stations, of which 160 are Dominion stations.

Complete returns have been received from 165 stations during the year. At 129 stations the precipitation was greater and at twenty-eight it was less than during 1916-17. The records show increases at ninety-three stations and decreases at sixty-eight, compared with the average for same for all years up to and including 1917-18. For all stations maintained ten years and upwards the records show increases at thirty-two and decreases at eight, compared with average for same up to and including 1917-18.

During the year seven minimum and twenty-seven maximum records were established at the stations indicated by *.

Maximum Records.—A new maximum yearly record has been established for all stations by the 301.16 inches registered during the year at Swanson Bay, where the previous highest yearly record for any station was established in 1907-8, when 205.58 inches was registered.

At Lake Buntzen Station, which has been maintained for fifteen years, the precipitation was 123.96 inches, thus establishing a new maximum record for this station. This is the only station out of all the stations maintained for ten years and upwards where a new record was established; the previous maximum record for this station was 123.32 inches in 1904-5.

Monthly maximum records were also established at this station as follows: 88 inches in November, 1917; 146 inches from October 1st to November 30th, 1917; and 206.34 inches in the four months ending January 31st, 1918.

Minimum Records.—With a precipitation of 5.28 inches, Ashcroft has the lowest record for the year. Further, by months, it has also established monthly records as follows: March 1st to April 30th, 0.001 inch; February 1st to April 30th, 0.20 inch; six months ending July 31st, 2.21 inches; and for the eight months ending September 30th, 2.49 inches.

Additional Data.—Particulars of economic value regarding precipitation which have an important bearing on all water-development questions are now given for the first time as follows:—

(*a.*) The annual precipitation table, giving the usual yearly data, has been extended and includes particulars of approximate elevations of 133 stations above mean sea-level. Also maximum and minimum yearly records established for all stations since they have been maintained.

(*b.*) A new table, giving some selected lowest precipitation records, which have been established for long periods at the various stations mentioned.

The tables herewith are compiled from all sources available and for all stations, whether maintained at present or not.

The two years given under records established refer to the water or climatic year, which extends from October 1st to September 30th.

In making use of these tables for average precipitation, reserve should be placed on the figures for a period of less than ten years.

Owing to the war it has been difficult to keep the records unbroken, and although the data for some months are missing, as a whole the Department has to thank the numerous observers for their thought and care during the past season.

Approx. Elevation above Mean Sea-level.	Station.	No. of Years of Complete Observation.	Average Precipitation.	Precipitation of Year.	Percentage above Average.	Percentage below Average.	Records Established.			
							Minimum.		Maximum.	
Feet.			Inches.	Inches.	Per Cent.	Per Cent.	Inches.	Years.	Inches.	Years.
90	Abbotsford	15	60.82	....	....	....	43.08	1889-90	79.56	1893-94
60	Agassiz	29	63.38	76.02	20.0	....	46.38	1889-90	89.41	1912-13
....	Ayansh	4	33.59	37.31	....	....	26.21	1914-15	41.42	1916-17
300	Alberni (Somass River)	20	71.70	....	....	....	64.68	1906-07	87.88	1904-05
....	" (Beaver Creek)	22	68.03	73.25	7.67	....	47.04	1916-17	94.04	1894-95
200	Alert Bay (Mission)	1	40.05	....	....	....	....	.....	....	.....
....	" (Wireless Station)	2	40.84	....	....	....	40.24	1916-17	41.45	1914-15
....	Alkali Lake	6	10.56	10.48	....	....	7.89	1916-17	13.52	1911-12
400	Alouette	7	100.41	109.96	....	....	82.41	1914-15	116.32	1912-13
....	Alvaston	3	11.20	12.09	....	....	8.24	1916-17	13.27	1915-16
....	Anyox (Granby Bay)	2	96.78	115.36	....	....	78.20	1916-17	115.36	1917-18
1,182	Armstrong	6	18.59	17.87	....	....	14.68	1916-17	23.19	1912-13
1,000	Ashcroft	4	7.48	5.28	....	....	5.28	1917-18*	9.12	1914-15
3,450	Aspen Grove	4	11.50	....	....	....	11.50	1916-17	19.54	1915-16
....	Atlin	13	10.75	13.93	29.6	....	6.91	1914-15	14.58	1908-09
2,220	Babine Lake	3	20.54	19.97	....	....	19.68	1909-10	21.97	1908-09
....	Bamfield	2	84.83	....	....	....	51.18	1905-06	118.47	1903-04
4,180	Barkerville	29	35.38	43.61	23.3	....	23.35	1896-97	46.85	1907-08
....	Baynes Creek	1	12.59	....	....	....	....	.....	....	.....
1,490	Bear Creek (Jordan River)	7	102.90	131.39	....	....	83.62	1911-12	131.39	1917-18*
....	Beaver Lake, V.I.	23	35.09	36.36	3.6	....	20.80	1914-15	45.31	1896-97
....	Bella Coola	17	43.72	58.17	33.0	....	29.61	1898-99	60.77	1913-14
....	Bevan, V.I.	4	60.65	58.04	....	....	36.48	1916-17	87.91	1915-16
1,420	Birchbank	5	24.93	21.47	....	....	21.88	1916-17	28.39	1913-14
1,650	Bonnington Falls	5	20.71	24.63	....	....	19.74	1916-17	31.19	1913-14
....	Boswell	3	25.90	22.86	....	....	22.86	1917-18*	28.57	1915-16
1,800	Bridge River	5	19.39	21.63	....	....	14.78	1914-15	21.66	1916-17
Sea level.	Britannia Beach	3	....	....	....	....	56.92	1916-17	85.31	1915-16
2,200	Britannia Mines (Tunnel Camp)	3	88.26	68.65	....	....	68.65	1917-18*	99.47	1915-16
2,600	Briscoe	5	17.19	17.06	....	....	13.59	1916-17	20.83	1915-16
....	Bullion (Quesnel Forks)	..	23.33	....	....	....	15.53	1904-05	29.78	1897-98
400	Buntzen Lake	15	109.60	123.96	13.0	....	80.10	1914-15	123.96	1917-18*
....	Bute Inlet	4	65.68	79.06	....	....	53.66	1916-17	79.06	1917-18*
1,250	Cache Creek	2	7.91	....	....	....	7.24	1915-16	8.58	1914-15
640	Cameron Lake	3	63.66	75.02	....	....	47.85	1916-17	75.02	1917-18*
2,650	Canal Flats	4	16.54	10.95	....	....	10.69	1916-17	22.52	1914-15
1,250	Canoe Point (Shuswap Lake)	7	23.08	....	....	....	18.50	1913-14	25.64	1915-16
....	Cape Scott	9	113.79	....	....	....	89.99	1898-99	146.82	1901-02
....	Capilano Intake	4	117.83	138.99	....	....	94.57	1916-17	138.99	1917-18*
....	Carcross (Yukon)	9	8.76	8.69	....	....	3.93	1914-15	12.42	1913-14
....	Carmanah	9	111.18	....	....	....	92.94	1897-98	136.49	1895-96
2,780	Carmi	5	17.71	15.60	....	....	11.84	1916-17	24.00	1914-15
3,100	Chilcotin (Big Creek)	14	13.01	14.41	10.75	....	8.23	1916-17	21.60	1906-07
21	Chilliwack	21	60.64	69.04	13.8	....	42.93	1914-15	71.98	1906-07
1,300	Chinook Cove	5	16.68	21.23	....	....	13.94	1913-14	21.23	1917-18*
1,460	Christina Lake	5	21.72	19.18	....	....	17.07	1916-17	25.32	1913-14

27	Clayoquot	18	122.07	127.66	4.6	....	97.84	1910-11	150.92	1900-01
....	Clo-oose	2	78.89	....	....	....	73.74	1914-15	84.05	1912-13
312	Cobble Hill (Boatswain Bank)	5	36.49	39.50	....	....	27.94	1914-15	46.39	1915-16
2,700	Coldspring Ranch (Quilchena)	4	11.82	....	....	....	8.46	1916-17	14.61	1914-15
34	Coquitlam	17	71.57	79.78	11.47	....	53.47	1914-15	81.66	1915-16
540	Coquitlam Lake	15	147.33	146.97	....	0.24	110.48	1916-17	166.87	1903-04
50	Cowichan Bay	4	34.71	35.16	....	....	27.53	1914-15	44.27	1915-16
540	Cowichan Lake	5	78.58	78.57	....	....	57.64	1916-17	94.80	1913-14
2,580	Cranberry Lake	3	17.50	19.25	....	....	13.27	1916-17	19.97	1915-16
3,020	Cranbrook	10	16.18	14.84	....	8.3	11.04	1903-04	25.31	1915-16
3,020	Cranbrook (City)	5	15.46	13.62	....	....	11.74	1916-17	22.49	1915-16
....	Crawford Bay	7	30.95	33.15	....	....	25.13	1913-14	45.97	1915-16
1,990	Creston	6	20.77	20.71	....	....	15.79	1916-17	24.78	1915-16
4,450	Crowsnest	2	16.58	....	....	....	14.22	1914-15	18.95	1915-16
....	Cumberland	2	57.67	....	....	....	56.98	1897-98	58.36	1896-97
....	Dawson	5	11.14	13.10	....	....	9.27	1914-15	13.10	1917-18*
1,400	Deer Park (Lower Arrow Lake)	3	16.18	....	....	....	14.42	1914-15	19.24	1915-16
....	Denman Island	10	49.81	45.72	....	8.2	35.73	1916-17	61.27	1913-14
2,580	Donald	3	23.51	....	....	....	18.97	1895-96	28.86	1897-98
....	Douglas Lake	3	12.47	....	....	....	11.87	1883-84	13.20	1894-95
170	Duncan	23	37.45	39.89	1.12	....	29.04	1894-95	57.21	1904-05
1,400	East Arrow Park	4	29.99	30.95	....	....	27.26	1916-17	33.21	1915-16
3,714	Echo Lake (Telegraph Trail)	4	23.05	22.68	....	....	21.24	1916-17	25.51	1915-16
2,620	Edgewater	2	14.83	....	....	....	13.06	1915-16	16.60	1913-14
3,150	Edith Lake	2	14.59	....	....	....	13.19	1915-16	15.98	1914-15
3,100	Elko	8	21.56	....	....	....	16.01	1913-14	28.46	1906-07
3,100	Elko (Town)	5	20.33	16.63	....	....	14.95	1916-17	26.24	1915-16
1,180	Enderby	14	21.07	22.10	4.9	....	16.12	1895-96	27.86	1898-99
....	Entrance Harbour	2	31.25	....	....	....	30.18	1916-17	32.33	1915-16
....	Estevan Point (Wireless)	1	90.31	....	....	....	....	....	....	.....
1,000	Fairview	2	5.40	....	....	....	4.30	1909-10	6.51	1910-11
1,780	Fauquier	4	24.78	....	....	....	20.45	1913-14	29.61	1910-11
2,100	Ferguson	10	48.15	50.55	5.0	....	40.08	1914-15	56.58	1912-13
3,305	Fernie	4	40.21	34.74	....	....	31.63	1914-15	52.55	1915-16
2,518	" (Dominion)	3	37.18	34.86	....	....	32.09	1916-17	44.59	1915-16
....	Fifth Cabin (Telegraph Trail)	4	38.69	43.87	....	....	31.29	1916-17	43.87	1917-18*
2,520	Fort Steele	3	17.74	....	....	....	12.75	1916-17	23.45	1915-16
....	French Creek	11	36.53	....	....	....	29.19	1896-97	47.16	1899-00
....	Gillies Bay (Texada Island)	2	40.72	....	....	....	29.25	1917-18	45.68	1913-14
4,072	Glacier	12	64.21	81.98	27.7	....	47.36	1914-15	81.98	1917-18*
1,400	Glenemma	3	24.95	....	....	....	19.50	1915-16	29.94	1916-17
250	Goat River Lodge (Powell River)	4	71.23	80.47	....	....	55.25	1916-17	85.17	1915-16
2,580	Golden	8	19.54	23.92	....	....	15.69	1902-03	23.92	1917-18*
....	Goldstream Lake, V.I.	22	68.60	67.94	....	0.96	41.26	1914-15	78.08	1909-10
980	Gooseneck Camp (Campbell River)	1	50.44	....	....	....	....	.....	....	.....
1,746	Grand Forks	9	16.73	18.16	....	....	15.37	1915-16	20.59	1911-12
1,750	" (City)	5	16.20	13.63	....	....	14.16	1916-17	21.55	1914-15
....	Grande Prairie	1	13.35	....	....	....	....	.....	....	.....
2,470	Greenwood	6	19.08	14.91	....	....	14.62	1912-13	24.87	1916-17
....	Griffin Lake	3	42.01	....	....	....	25.84	1892-93	59.79	1899-00
....	Harpers Camp	4	18.47	16.38	....	....	16.02	1915-16	25.01	1916-17
....	Hartley Bay	1	19.52	....	....	....	....	.....	....	.....
27	Hatzic	1	82.23	....	....	....	....	.....	....	.....
50	Hazelmere	6	52.96	....	....	....	37.44	1895-96	66.11	1893-94
1,030	Hazelton	4	19.30	21.82	....	....	16.99	1915-16	21.82	1917-18*
1,720	Hedley	14	11.83	12.46	5.3	....	7.68	1907-08	15.28	1910-11
4,600	Hedley (Nickel Plate Mine)	12	24.33	....	....	....	16.21	1914-15	47.05	1911-12
....	Holberg	8	122.96	117.48	....	....	98.87	1916-17	147.06	1913-14

* Records established during the year.

PRECIPITATION, 1917-18—*Continued.*

Approx. Elevation above Mean Sea-level.	Station.	No. of Years of Complete Observation.	Average Precipitation.	Precipitation of Year.	Percentage above Average.	Percentage below Average.	Records established.			
							Minimum.		Maximum.	
Feet.			Inches.	Inches.	Per Cent.	Per Cent.	Inches.	Years.	Inches.	Years.
300	Holt Creek (near Duncan)	1	39.18	....	....	....	....	.....	....	.....
120	Hope	10	52.96	59.36	12.1	....	34.16	1914-15	74.98	1878-79
....	Hornby Island	8	44.77	36.62	....	....	30.28	1908-09	58.58	1913-14
70	Ikeda Head	4	116.26	119.65	....	....	88.58	1914-15	159.96	1913-14
....	Invermere	4	12.70	13.57	....	....	9.20	1916-17	14.88	1914-15
2,900	„ (Experimental Farm)	5	12.86	13.83	....	....	8.43	1916-17	15.48	1915-16
3,340	„ (Comfort Ranch)	5	12.39	11.82	....	....	9.31	1916-17	14.96	1914-15
....	Ioco (Deer Lake)	2	81.52	89.89	....	....	73.15	1916-17	89.89	1917-18*
....	James Island	4	25.68	31.58	....	....	18.34	1914-15	32.23	1915-16
2,000	Jones Lake	8	86.29	102.68	....	....	57.73	1914-15	105.67	1915-16
....	Jordan River, V.I.	10	68.35	79.37	16.15	....	49.90	1914-15	79.65	1915-16
1,150	Kamloops	25	10.40	12.08	16.15	....	6.73	1907-08	16.08	1878-79
1,760	Kaslo	6	22.88	....	....	....	18.90	1914-15	27.64	1912-13
1,200	Kelowna (Town)	19	12.45	13.18	5.94	....	7.90	1916-17	16.65	1906-07
....	„ (Bankhead)	2	11.01	13.30	....	....	8.73	1916-17	13.30	1917-18*
1,870	„ (Rutland)	7	10.78	7.75	....	....	4.77	1916-17	13.39	1911-12
4,120	„ (Hydraulic Summit)	5	20.46	13.77	....	....	19.91	1915-16	24.81	1913-14
1,361	Keremeos (Centre)	5	9.80	7.67	....	....	7.46	1916-17	12.51	1913-14
....	„ (Town)	4	8.98	....	....	....	6.24	1891-92	11.42	1913-14
....	Kingcome	1	75.84	....	....	....	....	.....	....	.....
2,600	Kingsgate	4	26.45	25.23	....	....	21.72	1916-17	32.73	1915-16
....	Kitimat	3	82.50	....	....	....	73.16	1906-07	92.11	1905-06
3,000	Klinaklini	2	14.66	....	....	....	12.53	1915-16	16.80	1914-15
3,000	Knouff Lake	3	16.72	16.80	....	....	15.82	1915-16	17.55	1916-17
1,765	Kootenay Lake (Reclamation Farm)	7	23.11	....	....	....	20.74	1896-97	26.34	1902-03
....	Kuper Island	9	42.94	....	....	....	35.85	1894-95	54.44	1899-00
....	Ladner	18	35.10	37.00	5.4	....	21.12	1914-15	44.54	1880-81
80	Ladysmith	5	49.32	41.28	....	....	41.28	1917-18*	64.75	1915-16
....	Langley	13	54.17	....	....	....	43.39	1887-88	80.31	1899-00
....	Lazo (Wireless Station)	4	44.54	47.27	....	....	36.63	1916-17	48.26	1915-16
....	Lazy "L" Ranch	2	17.51	....	....	....	17.48	1913-14	17.54	1914-15
840	Lillooet	7	13.33	10.05	....	....	9.55	1877-78	22.27	1878-79
....	Little Qualicum	8	36.75	32.75	....	....	26.67	1916-17	50.77	1915-16
....	Lumby	2	17.08	....	....	....	14.94	1913-14	19.22	1914-15
1,900	Lynch Creek	5	21.71	23.15	....	....	19.57	1916-17	23.15	1917-18*
637	Lynn Creek	5	94.13	90.38	....	....	53.59	1914-15	122.78	1915-16
....	Lytton Halfway House	1	....	4.43	....	....	....	.....	....	.....
700	Lytton Town	1	....	15.34	....	....	....	.....	....	.....
1,215	Malakwa	4	28.28	26.04	....	....	24.76	1916-17	32.56	1915-16
3,300	Mamete Lake	3	12.85	....	....	....	10.70	1916-17	18.48	1913-14
....	Mary Island	4	48.42	49.85	....	....	43.70	1916-17	53.18	1915-16
....	Masset	18	52.88	68.78	30.00	....	31.89	1906-07	85.52	1897-98
213	Metchosin	2	44.23	44.44	....	....	44.02	1915-16	44.44	1917-18*
....	McCoy Lake	1	86.49	....	....	....	....	.....	....	.....
....	McClure Lake	4	15.70	15.11	....	....	10.16	1916-17	24.51	1914-15
1,915	Midway	7	12.67	....	....	....	8.29	1901-02	16.55	1898-99

30	Mill Bay (Nass)	5	80.78	97.54	....	....	57.20	1914-15	97.54	1917-18*
....	Moha (Bridge River)	5	13.57	13.53	....	....	10.80	1916-17	18.52	1915-16
....	Monte Creek (Ducks)	9	9.82	8.81	....	....	7.41	1916-17	13.25	1914-15
1,420	Nakusp	6	27.54	28.02	....	....	23.21	1916-17	30.44	1915-16
....	Nanaimo (Bray's)	12	44.90	....	....	....	36.44	1898-99	59.04	1899-00
125	„	16	38.80	34.53	....	11.0	29.49	1916-17	52.57	1904-05
....	„ (Biological Station)	5	35.82	34.50	....	....	29.49	1916-17	43.68	1915-16
....	Nanoose Bay	6	31.29	29.18	....	....	25.34	1916-17	38.62	1913-14
1,150	Naramata	4	11.19	11.61	....	....	10.24	1915-16	11.99	1914-15
....	Nass Harbour	18	81.94	79.63	....	2.82	56.63	1914-15	94.95	1905-06
1,780	Nelson	15	26.77	29.09	8.65	....	21.67	1910-11	35.76	1906-07
1,800	New Denver	4	32.32	36.62	....	....	28.99	1914-15	36.62	1917-18*
2,400	Newgate (Yakite Ranch)	3	17.50	....	....	....	15.42	1913-14	20.11	1914-15
330	New Westminster	27	57.65	63.13	9.5	....	43.99	1914-15	75.32	1899-00
3,100	Nicola (Clapperton Creek)	5	15.54	15.61	....	....	12.87	1913-14	18.50	1914-15
2,120	Nicola Lake	37	11.07	....	....	....	6.92	1916-17	16.83	1902-03
....	Ninth Cabin (Telegraph Trail)	1	25.46	....	....	....	....	.....	....	.....
....	Nitinat Lake	4	117.16	121.00	....	....	95.96	1916-17	160.10	1915-16
500	North Bend	3	35.97	38.46	....	....	23.73	1916-17	45.72	1915-16
59	North Nicomen	24	74.56	80.87	8.5	....	52.46	1914-15	106.14	1893-94
....	Observation Bay	3	74.16	72.51	....	....	71.79	1916-17	78.07	1915-16
....	Ocean Falls	4	156.07	152.11	....	....	141.01	1914-15	185.22	1909-10
2,850	105-Mile House	5	12.89	16.10	....	....	9.21	1915-16	16.10	1917-18*
....	Parksville	3	31.88	32.69	....	....	25.74	1916-17	40.20	1915-16
2,600	Pavilion	1	10.77	....	....	....	....	.....	....	.....
1,500	Peachland (Trepanier Creek)	4	15.17	13.49	....	....	11.04	1916-17	18.48	1914-15
700	Pemberton Meadows	6	32.27	41.45	....	....	20.72	1916-17	41.45	1917-18*
....	Pemberton Hatchery	9	37.25	34.45	....	....	22.14	1916-17	38.16	1908-09
1,150	Penticton	11	11.36	9.81	....	13.4	8.56	1916-17	14.48	1914-15
1,730	Perry Siding	5	25.71	26.95	....	....	21.35	1916-17	30.66	1915-16
4,603	Phoenix	5	27.63	24.07	....	....	24.01	1917-18*	31.70	1913-14
1,760	Pilot Bay (Kootenay Lake)	2	39.73	....	....	....	....	.....	....	.....
....	Point Grey	1	44.85	....	....	....	....	.....	....	.....
....	Porcher Island	1	81.06	....	....	....	....	.....	....	.....
....	Port Essington	4	122.86	....	....	....	112.56	1904-05	138.21	1901-02
20	Port Moody	6	66.83	....	....	....	52.03	1914-15	77.75	1890-91
....	Port Simpson	19	89.30	....	....	....	59.48	1902-03	113.43	1894-95
300	Powell Lake (upper end)	4	91.91	88.37	....	....	75.15	1916-17	114.18*	1915-16
....	Powell River	4	38.62	38.07	....	....	33.38	1916-17	49.19	1915-16
1,870	Prince George	4	18.53	18.68	....	....	13.04	1916-17	28.32	1912-13
....	Prince Rupert	9	106.35	100.90	....	....	76.96	1911-12	124.13	1913-14
....	Princeton	20	13.18	13.74	4.25	....	7.61	1894-95	20.40	1902-03
3,515	Princeton Crossing	2	24.58	....	....	....	22.46	1914-15	26.69	1915-16
173	Qualicum Beach	2	31.23	35.24	....	....	27.23	1916-17	35.24	1917-18*
....	Quatsino	15	107.44	104.70	....	2.55	74.86	1916-17	135.29	1905-06
....	Queen Charlotte City (Graham Island)	4	61.25	73.98	....	....	45.25	1914-15	73.98	1917-18*
1,600	Quesnel	18	15.57	21.04	3.32	....	11.16	1915-16	21.40	1906-07
2,900	Quilchena (Dry Farm), Nicola P.O.	5	13.47	14.52	....	....	8.49	1916-17	16.30	1915-16
1,500	Revelstoke	17	41.52	45.59	9.8	....	34.34	1904-05	51.92	1906-07
....	Richlands (near Lumby)	2	21.30	....	....	....	....	.....	....	.....
....	Rivers Inlet	12	112.81	....	....	....	88.32	1897-98	130.15	1899-00
....	Rock Creek	6	15.03	13.43	....	....	11.11	1913-14	19.04	1906-07
3,400	Rossland	12	29.36	25.67	....	12.5	24.60	1905-06	38.04	1906-07
1,170	Salmon Arm (Hobson)	11	18.96	....	....	....	12.84	1895-96	26.34	1906-07
1,170	„ (Sharp)	7	19.15	21.15	....	....	16.05	1913-14	22.55	1914-15
....	Saltspring Island	8	39.34	39.96	....	....	31.35	1914-15	50.39	1915-16
....	Sandwick	4	51.59	51.59	....	....	39.93	1916-17	66.37	1915-16
465	Seymour Intake	5	107.84	117.91	....	....	88.80	1916-17	120.17	1915-16

* Records established during the year.

PRECIPITATION, 1917-18—*Concluded.*

Approx. Elevation above Mean Sea-level.	Station.	No. of Years of Complete Observation.	Average Precipitation.	Precipitation of Year.	Percentage above Average.	Percentage below Average.	Records established.			
							Minimum.		Maximum.	
Feet.			Inches.	Inches.	Per Cent.	Per Cent.	Inches.	Years.	Inches.	Years.
400	Shawnigan Lake	6	40.48	.....	....	....	27.15	1914-15	57.02	1915-16
1,690	Soda Creek	4	12.04	13.97	....	....	4.48	1884-85	13.97	1917-18*
25	Sooke Harbour	6	41.86	37.82	....	....	30.44	1914-15	52.98	1915-16
....	Sooke Lake	7	66.87	73.68	....	....	42.46	1914-15	79.49	1915-16
1,180	Sorrento	5	17.99	20.05	....	....	14.01	1913-14	20.60	1914-15
790	Spences Bridge	11	9.44	....	....	....	5.67	1895-96	13.49	1893-94
80	Sproat Lake	1	47.32	....	....	....	....	.....	....	.....
....	Stave River Falls (Ruskin)	9	79.17	91.79	....	....	61.88	1914-15	92.59	1915-16
6	Steveston	22	36.01	32.21	....	10.7	28.95	1914-15	45.99	1904-05
....	Stewart	5	74.26	83.91	....	....	53.44	1914-15	93.72	1916-17
2,200	Stuart Lake	24	16.08	16.14	0.37	....	9.79	1898-99	24.88	1908-09
1,100	Summerland	11	11.02	8.82	....	2.00	8.54	1909-10	14.30	1911-12
....	Surf Inlet	2	185.01	216.89	....	....	153.14	1916-17	216.89	1917-18*
....	Swanson Bay	6	203.28	301.16	....	....	163.38	1911-12	301.16	1917-18
....	Swift River (Cariboo)	1	22.93	....	....	....	....	.....	....	.....
200	Sidney (Experimental Farm)	4	30.22	29.16	....	....	25.21	1914-15	37.12	1915-16
1,158	Tappen	5	21.54	21.31	....	....	18.09	1913-14	25.01	1914-15
220	Terrace	4	41.52	53.34	....	....	35.64	1916-17	53.34	1917-18*
2,400	Tete Jaune Cache	2	14.42	....	....	....	12.93	1915-16	15.90	1914-15
....	Thetis Island	2	36.57	....	....	....	....	.....	....	.....
1,500	Thrums	5	27.52	26.98	....	....	24.57	1916-17	30.23	1913-14
....	Tobacco Plains	6	17.21	....	....	....	13.15	1903-04	19.54	1898-99
....	Tranquille	5	9.32	....	....	....	6.59	1916-17	11.64	1911-12
....	Triangle Island	7	64.19	60.31	....	....	44.59	1914-15	84.44	1910-11
....	Ucluelet	4	103.91	85.79	....	....	85.79	1917-18*	128.48	1915-16
....	Valdes Island	2	58.83	....	....	....	....	.....	....	.....
....	Vancouver	16	58.64	60.48	3.17	....	44.72	1914-15	67.14	1901-02
100	Vancouver (City Hall)	5	58.38	65.28	....	....	45.34	1914-15	65.28	1917-18*
....	" (Court-house)	1	56.62	....	....	....	....	.....	....	.....
2,093	Vanderhoof	2	17.07	17.57	....	....	16.58	1916-17	17.57	1917-18*
....	Vavenby	5	14.19	14.11	....	....	12.98	1915-16	16.11	1914-15
1,580	Vernon (Coldstream Ranch)	18	14.21	14.41	1.48	....	9.86	1895-96	17.67	1911-12
....	Victoria	44	29.30	30.77	5.0	....	17.18	1914-15	54.42	1893-94
1,358	Waneta	5	28.59	26.11	....	....	26.05	1914-15	33.75	1915-16
....	Westley	3	25.46	25.51	....	....	23.24	1914-15	27.64	1916-17
3,300	Wilmer	8	13.77	15.10	....	....	11.57	1916-17	15.69	1914-15
....	Wycliffe	1	8.96	....	....	....	....	.....	....	.....

* Records estblished during the year.

Selected Lowest Precipitation Records.

(Columns 6 to 12 give the total depths in inches for the number of months duration of each station record.)

West of Coast Range.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Station.	No. of Years of Complete Observation.	Average Precipitation up to & including 1917-18.	Year.	Precipitation of Year.	Length of Record in Months.						
					2.	3.	4.	5.	6.	7.	8.
		Inches.		Inches.			Total	Depth in	Inches.		
Alberni (Beaver Creek)	22	68.03	1895-6	53.71	0.24	0.38	1.41	3.00	...	...	...
Beaver Lake, V.I.	23	35.09	1907-8	35.07	0.46	1.29	1.93	2.54	...	...	...
Coquitlam	17	71.57	1914-15	53.47	1.65	3.12	4.27	...	...	...	...
Coquitlam Lake	15	147.33	1913-14	130.82	1.87	7.13	11.84	...	...	...	...
Duncan	23	39.45	1886-7	44.00	0.03	1.22	...	...	...	...	...
„	23	39.45	1890-1	39.81	0.26	0.86	3.39	...	...	...	...
Denman Island	10	49.81	1914-15	50.09	0.21	0.82	2.27	...	...	...	...
Goldstream	22	68.60	1900-1	73.02	0.33	2.15	...	...	...	...	...
„	22	68.60	1907-8	60.22	0.44	1.62	2.59	...	...	...	...
Langley	13	54.17	1884-5	46.89	0.35	1.42	...	...	...	...	...
Shawnigan	6	40.48	1913-14	43.34	0.21	2.81	...	...	...	...	...
Sooke Lake	6	66.87	1914-15	42.46	0.43	1.82	2.32	...	...	...	...
Victoria	44	29.30	1873-4	15.93	0.30	0.59	1.11	1.84	2.62	...	...
„	44	29.30	1884-5	28.70	0.08	0.33	1.63	2.16	2.48	...	...
Dry Belt.											
Aspen Grove	4	11.50	1913-14	14.06	0.00	0.00	1.25	3.25	3.90	...	...
Atlin	13	10.73	1916-17	7.52	0.21	0.34	0.63	1.82	3.10	...	...
Cache Creek	2	7.91	1917-18	...	0.00	0.00	0.00	0.67	2.26	2.26	2.26
Carcross	9	8.76	1914-15	3.93	0.05	0.20	0.52	0.82	0.97	1.52	...
Clinton	5	4.36	1884-5	3.43	0.00	0.07	0.15	1.35	1.55	1.85	...
„	5	4.36	1885-6	2.54	0.00	0.18	0.27	0.73	1.33	1.53	1.73
Fairview	2	5.40	1905-6	...	0.05	0.07	1.19	...	...	...	...
„	2	5.40	1909-10	4.30	0.23	0.42	0.77	1.13	1.36	1.49	...
Kelowna (Rutland)	7	10.78	1917-18	7.75	0.11	0.19	0.38	0.66	0.67	1.09	1.65
Kelowna (Hydraulic Summit)	6	20.46	1917-18	13.77	0.00	0.05	0.20	0.40	1.50	2.55	...
Keremeos	5	9.80	1917-18	7.67	0.00	0.00	0.23	1.03	2.32	...	...
Princeton	20	13.18	1896-7	11.73	0.00	0.00	0.20	1.20	3.09	...	...
Soda Creek	4	12.08	1883-4	4.77	0.00	0.00	0.17	0.65	1.20	1.40	1.90
Spences Bridge	11	9.44	1895-6	5.67	0.01	0.04	0.08	0.34	1.00	1.27	2.22
Stuart Lake	24	16.08	1897-8	9.97	0.00	0.45	0.52	0.82	1.54	2.48	...

SELECTED LOWEST PRECIPITATION RECORDS—*Concluded.*

East of Dry Belt.

Cranbrook	10	16.18	1911-12	12.41	0.38	0.58	1.66	2.70	3.80	...	...
Fort Steele	3	17.74	1914-15	17.04	0.51	1.26	2.21	2.96	...	...	...
Invermere	4	12.70	1916-17	9.20	0.35	0.63	0.78	1.23	1.75	2.36	...
Nelson	15	26.72	1909-10	22.35	0.36	1.91	...	...	...	...	...
Revelstoke	17	41.52	1905-6	37.35	1.91	3.99	...	...	...	...	...
Rossland	12	29.36	1916-17	...	0.34	1.43	...	...	...	...	...
Salmon Arm	7	19.15	1896-7	...	0.00	0.25	0.75	3.40	...	...	...

APPENDICES TO WATER REPORT.

APPENDIX No. 1.

WATER POWERS OF BRITISH COLUMBIA.

In preparing the list a careful analysis was made of all water records, licences, engineers' and surveyors' reports, and 457 sites were indexed. In many instances, however, the information available was scanty and insufficient to check the amount of power given. In the list, wherever the figures are uncertain, note is made under the "Remarks" column.

The 270 power-sites given are divided under the following heads:—

Wholly or partially developed	30
Sites applied for	93
Sites known and unstaked	147

With regard to those power-sites located by the Commission of Conservation, the figures must for the present be taken with reserve. A. V. White, of the Commission, intimates that it is unnecessary to emphasize the paucity of the hydrographic information existent for the northerly part of the Province. With respect to the estimates given, while these were based on such data as were available, it is clear that without explanation the quantities mentioned might be misleading. When the report on the "Water-powers of British Columbia" is published, in connection with the tabular material relating to horse-power, there will be explanatory notes and comments, also description governing the use of the tables.

WATER-POWERS OF 500 HORSE-POWER AND OVER.

No.	Creek.	Tributary of.	H.P.	Applicant or Licensee.	Remarks.	Source of Information.
	ALBERNI WATER DISTRICT—					
1*	Ash River	Stamp and Somas Rivers	11,500			Water Rights Branch, 1913 Report, p. 40.
2†	Beaver Creek	" "	3,000	Alberni Hydro-Elec. Power Co.		Application.
	Drinkwater River—	Great Central Lake.				
3†	Della Falls	875		Big Interior Gold Mines, Ltd.		
4*	Rapids below Lower Canyon	4,300				
5*	Lower Canyon	3,325				
6*	Between Lower and Upper Canyon	1,880				
7*	Between Upper Canyon and Bridge	2,400				
8*	Drinkwater Falls	1,050				
			13,830			1913 Report, p. 40.
10*	Great Central Lake	Stamp and Somas Rivers	21,900		Alternative to development on Upper Stamp River	" p. 40.
11*	McBride Creek	Great Central Lake	800			" p. 40.
12†	Nahmint River	Alberni Canal	2,400	Central Island Power Co., Ltd.		" p. 41.
14†	Sarita River	Barkley Sound	3,350	British Pacific Hydro-Elec. & Tramways, Ltd.		Application.
15†	Sproat River	Somas River	6,400	Vancouver Island Elec. Railways Co., Ltd.		1913 Report, p. 40.
16*	"	"	7,600		Additional to normal power and dependent on Great Central Lake Development (*see* No. 10)	" p. 41.
17†	Stamp River	"	19,000	Ritchie-Agnew Power Co., Ltd.		1913 Report, p. 40, and company's data.
18*	Upper Stamp River	"	3,800			1913 Report, p. 40.
19*	View Lakes	Great Central Lake	1,200			" p. 40.
20†	Gold River	Muchalat Arm	4,000	G. J. Cox		Application.
	ASHCROFT WATER DISTRICT—					
1†	Anderson River	Fraser River	8,500	Imperial Power Co.		Application.
3*	Coquihalla River	"	8,400			1913 Report, p. 44.
4†	Emory Creek	"	3,000	Imperial Power Co.		Application.
7†	Nahatlatch River	"	30,000	"		B.C. Hydrographic Survey Report, 1913, p. 239.
8†	Nicolum River	Coquihalla River	10,000	McKenzie & Mann	Included in figures given for joint scheme (*see* No. 14).	
10†	Silver River	Fraser River	11,500	Silver River Power Co.		Application and B.C. Hydrographic Survey Report, 1913, p. 127.
11†	Siwash Creek	"	4,000	Imperial Power Co.		Application.
12†	Skuzzy Creek	"	5,600	"		"
13†	Spuzzum Creek	"	10,000	"		"
14†	Sumallow River	Skagit River	35,000	McKenzie & Mann	Joint scheme with Nicolum River (*see* No. 8)	Data submitted by company.
15†	Texas Creek	Fraser River	3,000	Imperial Power Co.		Application.
16†	Yale Creek	"	3,600	"		"
	BARKERVILLE DISTRICT—					
18†	Swift River	Cottonwood River	10,000	Quesnel Hydr. Gold Mining Co.	Plant installed, not now in operation.	

	FERNIE WATER DISTRICT—					
2†	Bull River	Kootenay River	6,500	Bull River Elec. Power Co.		Water Rights Branch, 1912 Report, p. 95.
3†	Elk River	„	11,600	Crow's Nest Pass Electric Light & Power Co.		Ditto, p. 99.
5*	Phillips Creek	„	750			1913 Report, p. 74.
6†	Wild Horse Creek	„	850	D. F. Basden		Engineer's report.
	FORT FRASER WATER DISTRICT—					
1†	Stellaquo River	Fraser Lake	6,000	Fraser Lake Water & Power Co.		Application.
2*	Stony Creek	Nechako River	1,600			„
	FORT GEORGE WATER DISTRICT—					
1*	Beaver River	South Fork, Fraser River	900			Surveyor's estimate.
2*	Boulder Creek	Canoe River			Over 1,000 horse-power per mile	1912 Report, p. 32.
3*	Cottonwood River	South Fork, Fraser River	700			Surveyor's estimate.
4*	Fraser River		5,600		At Lower Falls	*See* No. 8.
5*	„		5,600		At Upper Falls	„
6*	Harvey Creek	Canoe River			Over 2,000 horse-power per mile	1912 Report, p. 32.
7†	Hixon Creek	Government Creek	850	E. Bloomfield		Application.
8†	Moose River	Fraser River	24,000	Yellowhead Pass Light & Power Co.		Data submitted by company.
9*	Raushuswap River	South Fork, Fraser River	2,000			Surveyor's estimate.
11†	Willow River	Fraser River	3,500	Fort George Power Co.		From low-water flow.
	GOLDEN WATER DISTRICT—					
1*	Blaeberry River	Columbia River	2,000			Data uncertain.
2*	Columbia River				Power-site at Surprise Rapids, horse-power unknown.	
3†	„		5,700	Canadian Pacific Rly.		Data submitted by company.
4*	Cummins Creek	Columbia River	3,800			1912 Report, p. 31.
5*	Spillimacheen River	„	3,850			1913 „ p. 77.
6*	Wood River	„	5,000			1912 „ p. 32.
	GRAND FORKS WATER DIST.—					
3‡	Kettle River	Columbia River	5,000	West Kootenay Light & Power Co.	Site at Cascade; developed.	
4‡	North Fork, Kettle River	„	700	Granby Mining, Smelting & Power Co.	Developed.	
	HAZELTON WATER DISTRICT—					
2§	Boulder Creek	Bulkley River	1,000	Grand Trunk B.C. Coal Co., Ltd.		
3§	Bulkley River	Skeena River	40,000		At Hagwilget Canyon.	
3A§	„	„	27,000		At Moricetown Falls.	
4§	Copper River	„	7,500			
6§	Mud Creek	Bulkley River	500			
7§	Skeena River		30,000		Kitsalas Canyon; proximity of railroad may interfere with development.	
8§	Bulkley River	Skeena River	20,000		At Beaumont Canyon.	
9§	„	„	25,000		Canyon 37 miles above Hazelton.	
10§	„	„	6,300		At Telkwa; proximity of railroad may interfere with development.	
12§	Canyon Creek	„	1,500			
14§	Driftwood Creek	„	750			
15§	„	Bulkley River	500			
18§	Gold River	Skeena River	600			
24§	Morice River	Bulkley River	8,000			
27§	Porphory Creek	„	500			
28§	Skeena River		20,000		Canyon just north of Hazelton.	

* Powers available. † Powers staked. ‡ Powers developed and under development. § Powers available, investigated by Conservation Commission of Canada.

WATER-POWERS OF 500 HORSE-POWER AND OVER—*Continued.*

No.	Creek.	Tributary of.	H.P.	Applicant or Licensee.	Remarks.	Source of Information.
	HAZELTON WATER DISTRICT—*Concluded.*					
29§	Skeena River		15,000		20 miles above Babine River.	
30§	"		10,000		Canyon near 3rd Telegraph Cabin.	
31§	"		14,000		Canyon 9 miles above 4th Telegraph Cabin.	
32§	Telkwa River	Bulkley River	700			
33§	"	"	1,000		Canyon near Pine Creek.	
36§	Big Slide Creek	Skeena River	1,300		Near 3rd Telegraph Cabin.	
	KAMLOOPS WATER DISTRICT—					
1†	Adams River	Shuswap Lake	6,500	B.C. Hydraulic Power Co.		Application.
2‡	Barriere River	North Thompson River	20,000	Kamloops Hydro-Elec. Co.	2,200 horse-power developed.	
6*	Canim Lake	Clearwater River			Horse-power unknown, but must be considerable.	
7†	Clearwater River	North Thompson River	2,000	Imperial Power Co.		Application.
14*	Myrtle River	Clearwater River			Helmcken and Dawson Falls.	
16*	Seymour River	Shuswap Lake	600			Data uncertain.
	KASLO WATER DISTRICT—					
2†	Cedar Creek	Kootenay Lake	1,700	Consolidated Mining & Smelting Co.		Application.
3‡	Coffee Creek	"	590	Kootenay Air Supply Co.	Developed.	
5†	Kaslo Creek (South Fork)	"	520	O. T. Stone		Application.
8‡	Tam O'Shanter Creek	"	520	New Canadian Metal Co.	Developed.	
	LILLOOET WATER DISTRICT—					
1†	Bridge River	Fraser River	147,000	Bridge River Power Co.		Data submitted by company.
2*	Cayoosh Creek	"	2,000-5,000			1913 Report, p. 51.
4†	Portage Creek	Seton Lake	900	Portage Creek Power & Light Co.		Application.
	NANAIMO WATER DISTRICT—					
2†	Campbell River	Seymour Narrows	85,000	Campbell River Power Co.		Data submitted by company.
4†	Englishman's River	Strait of Georgia	840	British Pacific Hydro-Elec. & Tramways, Ltd.		" " "
5*	Little Qualicum River	"				1913 Report, p. 40.
6‡	Millstone River	"	1,300	Nanaimo Elec. Light, Power & Heating Co.	Partial development.	
7*	Nanaimo River	"				
	Site No. 1	" 5,000				
	Site No. 2	" 11,200				
	Site No. 3	" 6,800				
	Site No. 4	" 3,000				
			26,000			Engineer's report.
9‡	Puntledge River	Comox Harbour	22,500	Canadian Collieries, Ltd.	12,000-horse-power plant in operation.	
10*	"	"	4,600		Site below Canadian Collieries development.	1913 Report, p. 40.
	NELSON WATER DISTRICT—					
5‡	Kootenay River	Columbia River	16,300	West Kootenay Light & Power Co.	Lower Bonnington Falls; 4,000 horse-power developed.	
6*	"	"	36,000		Bonnington Pool Falls.	1912 Report, p. 34.

7‡	Kootenay River	Columbia River	6,850	City of Nelson	Upper Bonnington Falls; 4,000 horse-power developed.	
8‡	"	"	23,000	West Kootenay Light & Power Co.	Up. Bonnington Falls; 16,000 horse-power developed.	
9*	"	"	.....	.....	Site at Granite Bridge	1912 Report, p. 34.
10*	"	"	20,000	.....	Canyon near Thrums	" p. 34.
12†	Pend d'Oreille River	"	84,000	Pacific Exploration Co.	Near junction with Columbia	1912 Report, p. 36, and application.
13*	"	"	24,500	.....	9 miles from mouth	1912 Report, p. 36.
14*	"	"	26,000	.....	15 miles from mouth	" p. 36.
15*	"	"	38,000	.....	At junction with Salmon River	" p. 36.
20*	Salmon River	Pend d'Oreille	4,000	.....	.....	" p. 38.
22†	Sheep Creek	Salmon River	800	Motherlode Sheep Crk. Min. Co.	.....	Data submitted by company.
23A†	"	"	640	Amalgamated Gold Mines of Sheep Creek, Ltd.	.....	Application.
23B†	"	"	800	R. H. Leach	.....	"
	New Denver Water Dist.—					
5†	Four-mile Creek	Slocan Lake	1,000	G. H. Aylard	.....	"
	New Westminster District—					
1†	Chehalis River	Harrison River	22,000	Canadian Pacific Rly.	Joint scheme with Statloo River gives 37,000 horse-power	Data submitted by company.
2†	Chilliwack River	Fraser River	70,000-100,000	Vancouver Power Co., Ltd. ...	.....	" "
3‡	Coquitlam and Buntzen Lakes	Fraser River and North Arm, Burrard Inlet	84,000	" " ...	Developed.	
4†	Green River	Lillooet Lake and River	16,000	Nairn Falls Power Co.	.....	" "
6†	Jones Lake	Jones Creek	29,000	Vancouver Power Co., Ltd. ...	.....	" "
7†	Lillooet River	Pitt River	25,000	Burrard Power Company	.....	" "
10†	Pemberton Creek	Lillooet River and Harrison Lake	950	Pacific Great Eastern Development Company	Only small portion of power staked	Application.
11†	Rushton Creek	Pitt Lake	1,000	E. J. Fader	.....	Application and B.C. Hydrographic Survey Report, 1913, p. 123.
13†	Statloo River	Harrison River	15,000	Canadian Pacific Rly.	See Chehalis River, No. 1.	
14‡	Stave River	Fraser River	75,000	Western Can. Power Co., Ltd.	70,000 horse-power developed.	
15†	Tamihy Creek	Chilliwack River	8,000	S. Fader	.....	Application.
16‡	Munro Creek	Pitt River	1,200	Gilley Bros., Ltd.	550 horse-power developed.	
	Prince Rupert District—					
1†	Ain River	Masset Inlet	7,800	British Canadian Lumber Corporation	.....	Data submitted by company.
2†	American Creek	Bear River	7,200	R. M. Stewart	.....	Application.
4†	Browns Creek	Ecstall River	8,000	Browns Sawmill Development	.....	"
5†	Cascade Creek	Salmon and Bear Rivers	1,200	Salmon Bear River Mining Co., Ltd.	.....	"
7‡	Falls River	Ecstall River	15,000	Prince Rupert Hydro-Elec. Co., Ltd.		
8†	Glacier Creek	Goose Bay	720	J. L. Parker	.....	"
13†	Khtada River	Skeena River	10,000	Prince Rupert Hydro-Elec. Co., Ltd.	.....	Data submitted by company.
15§	Kitsumgallum River	"	6,000	.....	.....	
16†	Kumeolon Creek	Grenville Channel	2,500	Grenville Development Co., Ltd.	.....	Application.
19†	Madeleine Creek	Ecstall River	3,200	Prince Rupert Hydro-Elec. Co., Ltd.	.....	"
22*	McKnight Creek	"	3,200	.....	.....	"
23†	Meziadin River	Nass River	.....	Canadian North Eastern Power Co., Ltd.		
24*	Mountain River	Rennell Sound	4,800	.....	.....	"
27*	Nass River	Portland Inlet	150,000	.....	.....	Surveyor's estimate.

* Powers available. † Powers staked. ‡ Powers developed and under development. § Powers available, investigated by Conservation Commission of Canada.

WATER-POWERS OF 500 HORSE-POWER AND OVER—*Continued.*

No.	Creek.	Tributary of.	H.P.	Applicant or Licensee.	Remarks.	Source of Information.
	PRINCE RUPERT DISTRICT—*Concluded.*					
28†	Kawon River (Quan)	Masset Harbour	650	British Canadian Lumber Cor., Ltd.	.....	Application.
29*	Raney River	Rennell Sound	2,150	.....	.....	,,
32†	Thulme River	Wark Channel	8,000	Corporation of Prince Rupert	.....	,,
33*	Twin River	Rennell Sound	1,200	.....	.....	,,
36‡	Woodworth Lake	Fern Passage	1,650	City of Prince Rupert	1,650 horse-power developed at present.	
37§	Aaltanhash River	Graham Reach	5,800	.....		
39§	"A" Tributary	Brim River	1,000	.....		
40§	Dome River	Aaltanhash Inlet	2,000	.....		
41§	Inlet Creek	Gardner Canal	800	.....		
42§	Kiltuish River	,, ...	2,500	.....		
43§	Lizette Creek	Mussel Inlet	4,500	.....		
44§	McAlpine Creek	,, ...	1,500	.....		
45§	Mussel Creek	,, ...	3,500	.....		
46§	Poison Cove River	,, ...	2,000	.....		
47§	Price River	Gardner Canal	500	.....		
48§	See-kwya-kin River	Kemano River	600	.....		
49‡	Swanson Bay River	Graham Reach	1,250	Swanson Bay Forests, Wood, Pulp & Lumber Mills, Ltd.	Developed.	
50§	To-cha-stes Creek	Kemano River	1,600	.....		
51§	Triumph River	Gardner Canal	4,500	.....		
52§	Wachwas Creek	,, ...	900	.....		
53†	Carter River	Finlayson Channel	5,000	Carter River Power Co.	.....	Application.
54†	Cougar Lake, etc.	Surf Inlet	900	Surf Inlet Power Co., Ltd. ..	.....	,,
55‡	Falls Creek	Observatory Inlet	7,325	Granby Consolidated Mining & Smelting Co.	7,325-horse-power plant installed.	
	PRINCETON WATER DISTRICT—					
1*	Ashnola River	Similkameen River	2,000	.....	.....	Data uncertain.
2†	Nehumpshan Creek	,, ...	1,600	South Okanagan Power Co. ..	.....	Application.
5*	Similkameen River	Okanagan River	.....	.....	Near Junction of Roche and Passayton Rivers.	
6‡	,, ...	,, ...	1,600	Daly Reduction Co., Ltd.	Developed.	
7†	,, ...	,, ...	2,200	Ashawota Power Co.	.....	Application.
8*	Susap Creek	Similkameen River	650	.....	.....	Data uncertain.
11‡	Twenty-mile Creek	,, ...	525	Daly Reduction Co.		
	QUESNEL WATER DISTRICT—					
3†	Niagara River	Quesnel Lake	800	Jovian Power Co.	.....	Application.
6†	Spanish Lake, etc.	Quesnel River	.....	L. Muller	.....	,,
7†	Swamp River	,, ...	.....	Atlas Power Co., Ltd., and Cariboo Power Co., Ltd.	.....	,,
	REVELSTOKE WATER DISTRICT—					
1*	Akolkolex Creek	Columbia River	4,000	.....	.....	B.C. Hydrographic Survey Report, 1913, p. 295; 1914, p. 431.
2*	Gold Creek West	,, ...	.....	.....	Averages 5,000 horse-power per mile	Water Rights Branch, 1912 Report, p. 32.
3‡	Illecillewaet River	,, ...	2,300	Revelstoke Power & Light Co.	Developed.	
6*	Smith Creek	,, ...	.....	.....	Averages 1,400 horse-power per mile	1912 Report, p. 34.
7*	Soard Creek	,, ...	.....	.....	Averages 2,800 horse-power per mile	,, p. 32.

	Vancouver Water District—					
1*	Ashloo Creek	Squamish River	2,000			Data uncertain.
3†	Brandt Creek	Indian River	1,500	Westminster Power Co.	*See* No. 17.	
5‡	Britannia Creek	Howe Sound	2,275	Britannia Mining & Smelting Co.	Developed (total power on creek).	
6‡	Buntzen Lake	Burrard Inlet	84,000	Vancouver Power Co., Ltd.	Developed (*see* No. 3, New Westminster District joint scheme).	
8†	Cedar Creek	Howe Sound	2,000	G. F. Whalen		Application.
9*	Chapman Creek (Mission Creek)	Gulf of Georgia	800			Engineer's report.
10†	Cheakamus River	Squamish River	34,000	British Columbia Power & Electric Co., Ltd.	There are other power-sites on this river which have not yet been investigated	Data submitted by company.
14†	Furry Creek	Howe Sound	3,000	Howe Sound Power Co.		" "
15†	Hixon Creek	Indian River	11,000	Westminster Power Co.	*See* No. 17.	
16§	Huaskin Lake	Drury Inlet	1,800			
17†	Indian River	Burrard Inlet 9,600		Westminster Power Co. ...		
	Brandt Creek	Indian River 1,500		" " ...		
	Hixon Creek	" 11,000		" " ...	All included in one scheme of development.	
	Norton Creek	" 4,700		" " ...		
	Young Creek	" 4,700		" " ...		
			31,500			" "
18‡	Jane Creek	Britannia Creek	900	Britannia Creek Mining & Smelting Co., Ltd.	Joint scheme with Marmot Creek (*see* Nos. 5 and 22).	
19†	Lloyd Creek	Homfray Channel	2,000	Crescent Sand & Gravel Co.		Application.
20†	Mamquam River	Howe Sound	7,200	Newport Water Co., Ltd.		"
21*	"	"	4,500			"
22‡	Marmot Creek	Britannia Creek	900	Britannia Mining & Smg. Co., Ltd.	Joint schemes with Jane Creek (*see* Nos. 18 and 5).	
23‡	Mill Creek	Howe Sound	2,000	B.C. Sulphite Fibre Co.	Partly developed.	
25†	Monmouth Creek	Squamish River	900	Pacific Great Eastern Development Co.		Data submitted by company.
26§	Neclectsconnay River	North Bentinck Arm	2,500			
27†	Norton Creek	Indian River	4,700	Westminster Power Co.	*See* No. 17.	
28‡	Powell River	Malaspina Strait	32,000	Powell River Pulp Co., Ltd.	24,000 horse-power already developed.	
30†	Sallust Creek	Burrard Inlet	1,170	Consolidated Contractors, Ltd.		Application.
31†	Shannon Creek	Howe Sound	1,700	Newport Brick & Tile Co.		Data submitted by company.
34†	Stafford River	Loughborough Inlet	4,000	Davidson Ward Co.		Application.
35*	Stony Creek	Cheakamus River	5,000			Surveyor's estimate.
36*	Tastsquam River	Bella Coola River	3,000			"
39†	Young Creek	Indian River	4,700	Westminster Power Co.	*See* No. 17.	
40§	Brem River	Toba Inlet	4,000			
41§	Canyon Creek	South Fork, Toba River	17,000			
42§	Chewson Creek	Toba Inlet	5,000			
43§	Dalley River	Rivers Inlet	700		2 sites.	
44§	Dean River	Dean Channel	1,200			
45§	Doos River	Rivers Inlet	6,000			
46§	Eckheimick River	Bute Inlet	4,000			
47§	Falls Creek	North Fork, Toba River	5,000			
48§	Forbes River	Homfray Channel	1,000			
49§	Genesse Creek	Rivers Inlet	2,000			
51§	Hatchery Creek	"	1,000			
52§	Hazel Creek	Toba River	3,500		At Mackenzie Falls.	
53§	Ice River	Bute Inlet	2,500			
54§	Ickna Creek	South Bentinck Arm	4,000			
55§	Indian River	Rivers Inlet	1,400			
56§	Klinaklini River	Knight Inlet	15,000			
58§	Memeky River	Salmon River (Johnstone Strait)	1,550		2 sites.	

* Powers available. † Powers staked. ‡ Powers developed and under development. § Powers available, investigated by Conservation Commission of Canada.

WATER-POWERS OF 500 HORSE-POWER AND OVER—*Concluded.*

No.	Creek.	Tributary of.	H.P.	Applicant or Licensee.	Remarks.	Source of Information.
	VANCOUVER WATER DISTRICT—*Concluded.*					
60§	Moses Creek	Rivers Inlet	600			
62§	Neechantz River	"	1,000			
63§	Noscall River	Dean Channel	7,000			
64§	Nusash River	"	600			
65§	Owens Creek	North Fork, Toba River	2,000			
66§	Rodell Creek	Bute Inlet	3,000			
67§	Salmon River	"	4,500			
68§	"	Johnstone Strait	1,200			
69§	Sandle Lake	Rivers Inlet	3,000	Good Hope Cannery Co.	Partly developed.	
70§	Scow Quiltz River	Dean Channel	4,000			
71§	Seymour River	Seymour Inlet	4,000			
72§	Sheemahantz River	Rivers Inlet	4,500			
73§	Sim Creek	Knight Inlet	6,500			
74§	Slide Creek	"	3,000			
75§	Summit Creek	South Fork, Toba River	1,500			
76§	Tahumming Creek	Toba Inlet	1,000			
77§	Talcomy River	South Bentinck Arm	1,400			
79§	Thomlinson Creek	South Fork, Toba River	5,500			
80§	Toba River (South Fork)	Toba Inlet	4,700			
81§	Little Toba River	"	1,600			
82§	Twenty-two-mile Creek	Bute Inlet	3,000			
84§	Unnamed river	Ellerslie Channel	1,800			
85§	"	"	2,000			
86§	Wah-kash Creek	Knight Inlet	6,000			
88§	White River	Johnstone Strait	5,000			
89‡	Scott-Goldie Creek (Crocker Creek)	North Arm, Farrard Inlet	1,500	Scott-Goldie Quarry Co., Ltd.	Partly developed.	
9‡	Link River	Dean Channel	12,500	Ocean Falls Co., Ltd.	Developed.	
91‡	Granite Falls Creek	Vancouver	.....	Coast Quarries, Ltd.	Partly developed; information incomplete.	
	VERNON WATER DISTRICT—					
2†	Mission Creek	Okanagan Lake	1,000	Felgo-Canadian Fruitlands Co.		Application.
3†	Shuswap River	Mabel Lake	1,200	Couteau Power Co.		Data submitted by company.
4†	"	"	4,150	"		" "
	VICTORIA WATER DISTRICT—					
5‡	Goldstream	Saanich Arm	2,500	B.C. Electric Rly.	Developed.	
6†	Gordon River	.....	.....	British Pacific Hydro-Elec. & Tramways, Ltd.		Application.
8‡	Jordan River	.....	25,000	Vancouver Island Power Co.	Developed.	
10†	Nitinat River	Nitinat Lake	720	Central Island Power Co.		"
11†	Nimpkish River	Broughton Strait	67,000	E. L. Kinman		"
12†	McGoogin Creek	Nitinat River	6,000	J. R. McKinnel and others		"
17§	Amazon Creek	Quatsino Sound	1,100			
18§	Benson River	"	1,000			
19†	Kokish River	Broughton Strait	10,000	White Bros. Lumber Co.		"
20§	Marble Creek	Quatsino Sound	8,200	Colonial Lumber Paper Mills, Ltd. (one site only)	Total for 3 sites.	
23§	Upper Nimpkish River	Broughton Strait	3,500		Camosin Canyon.	
24§	"	"	3,000		Big Falls above Moss River.	
25§	"	"	1,500		Above mouth of Davie Creek.	
26§	Quatze River	Hardy Bay	500			

27§	Raging River	Quatsino Sound	1,500			
28§	Shushartie River	Queen Charlotte Sound	1,200			
29§	Tsi-itka River	Johnstone Strait	500			
	Windermere Water Dist.—					
1*	Findlay Creek	Kootenay River	6,400		Total of several powers of 2,000 horse-power and under	1913 Report, p. 77.
2*	Forster Creek	Columbia River	4,000		Total of 2 sites	" p. 77.

* Powers available. † Powers staked. ‡ Powers developed and under development. § Powers available, investigated by Conservation Commission of Canada.

APPENDIX No. 2.

HOW TO ACQUIRE A "CLASS A" OR "CLASS B" LICENCE TO TAKE AND USE WATER.

The Province has been divided into thirty-one "Water Recording Districts," the boundaries of which follow as nearly as possible the main watersheds, and a "Local Recorder," in most cases the Government Agent, appointed for each district. The Local Recorder acts as a "Recorder," the active administration in the more important districts being in the hands of a "District Engineer," whose duties are defined by the "Water Act, 1914," and who is subject to the Comptroller of Water Rights, whose office is at Victoria, B.C., and in whom alone is vested the power to approve an application and grant a licence. The printed forms of notice, application, etc., may be obtained on application to the office of any Water Recorder, District Engineer, or to the Comptroller's office.

Licences may be granted for the use of water for any of the following purposes: Domestic, waterworks, mineral-trading, irrigation, mining, steam, fluming, hydraulicking, industrial, power, clearing-streams, storage, conveying, and lowering-water.

As the water may be required in varying quantities, the applications have been classified as follows: "Class A," "Class B," and "Class C," the definitions of these classes being as follows:—

"Class A," in reference to any application or licence, means any application or licence for "domestic," "mineral-trading," or "steam purpose"; or for "mining" or "industrial purpose" where the water is to be used in quantities not exceeding 100,000 gallons per day; or for "irrigation purpose" where the acreage to be irrigated does not exceed 640 acres; or for "power purpose" where the power to be developed does not exceed 100 horse-power and is to be used by the applicant only: Provided that, if in the opinion of the Comptroller the nature of the works intended is such as to require the submission of detail plans, he may place any application which might come within the foregoing classification into "Class B" notwithstanding the foregoing limitations:

"Class B," in reference to any application or licence, means an application or licence for "mining" or "industrial purpose" where the water is to be used in quantities exceeding 100,000 gallons per day; for "irrigation purpose" where the acreage to be irrigated exceeds 640 acres; or for "storage purpose" or "hydraulicking purpose" or "clearing-streams purpose" or "fluming purpose" where the water is to be used by the applicant only; or for "power purpose" where the power to be developed exceeds 100 horse-power and is to be used by the applicant only; or for "lowering-water purpose": Provided that, if in the opinion of the Comptroller the nature of the works is such as not to require the submission of detail plans, he may place any application or licence which might come within the above classification into "Class A" notwithstanding the foregoing limitations:

"Class C," in reference to any application or licence, means a licence by virtue of which water is held in gross, whether by special Statute or otherwise; or an application or licence for "power," "hydraulicking," "clearing-streams," or "fluming purposes" where tolls are to be charged; or for "waterworks" or "conveying purposes."

A licence in respect of a "Class A" or "Class B" application can be obtained by an "owner," "owner" being defined by the Act as:—

(*a.*) Any registered owner in the book of indefeasible or absolute fees in any Land Registry Office in the Province:

(*b.*) Any purchaser or lessee in a registered agreement for purchase or lease:

(*c.*) Any applicant to register his title as owner or his agreement for purchase or lease:

(*d.*) Any pre-emptor, homesteader, or purchaser from the Crown in the right of either the Dominion or the Province, or any applicant to so pre-empt, homestead, or purchase:

(*e.*) Any timber licensee or lessee:

(*f.*) Any other lawful occupant of land or of a mine:

(*g.*) Any legal representative of an owner (as herein defined) who has died, become insolvent, is a minor, is of unsound mind, or is otherwise under disability:

(*h.*) Any receiver or liquidator of a company which is the owner (as herein defined) of land.

A licence in respect of a "Class C" application can only be acquired by a municipality empowered by an Act of the Legislature or to a company authorized by its memorandum of association or by some Act of the Legislature to acquire such licence, and in no case until the undertaking has been approved under the "Water Act, 1914."

The initial procedure to obtain a "Class A" or "Class B" water licence is as follows:—

(1.) Post notices at or near the point of diversion and place of use:

(2.) File the notice in duplicate in the office of the Water Recorder for the district in which the proposed point of diversion is situate:

(3.) At the same time as filing serve the notice upon each owner whose land will be touched or in any way affected by the proposed works:

(4.) Forthwith after posting on the ground, advertise the notice in a local newspaper once a week for four weeks:

(5.) Within ten days after the date of the first publication, file the formal application in duplicate in the Water Recorder's office.

The following is a more detailed summary of the procedure of the requirements of the "Water Act":—

First Step—Posting Notices.

The applicant shall post on the ground at conspicuous points near the proposed point of diversion and proposed place of use a notice of his intention to apply for a licence; although printed forms are supplied, the Act does not require that the notice follow any particular form, but it must give the following particulars:—

(*a.*) The name and address of the applicant:

(*b.*) The Water Recorder's office in which the application is to be filed:

(*c.*) The name or a clear description of the stream the water of which is to be diverted or used:

(*d.*) The quantity of water applied for in acre-feet per annum, cubic feet per second, gallons per day, or miners' inches:

(*e.*) The proposed point or points of diversion:

(*f.*) The purpose for which the water is to be used:

(*g.*) The number of the lot or section (and, if subdivided, the number or description of the subdivision) of the land or mine, and, if a mine, the name of the mine, upon which land or mine the water or power is to be used:

(*h.*) The date when the notice was posted on the ground.

Second Step—Filing and serving Copies of the Notice.

Forthwith after the posting of the notice on the ground as above, notices to the same effect shall be filed in the office of the Water Recorder for the district in which the proposed point of diversion is situate, and served upon each owner whose land will be touched or in any way affected by the proposed works. Proof of this service is required.

Third Step—Advertisement.

A notice giving all the particulars mentioned above, and, in addition, the date of the first publication and stating that objections may be filed with the Comptroller or with the Water Recorder within thirty days from such date, shall forthwith be published once a week for four weeks in a newspaper published in each district affected.

Fourth Step—The Application.

Within ten days from the first appearance of the notice in the local paper, the application, on forms to be supplied, must be filed in duplicate in the office of the Water Recorder where the notice was filed. The sketch on the application form need not be to scale, but must show the point of diversion, the lands crossed or affected, and generally outlining the scheme. The Local Recorder then forwards the application to the Comptroller, who checks the application and advises the applicant of the further requirements and of the amount of fees payable.

FIFTH AND SIXTH STEPS—ADDITIONAL INFORMATION AND FEES.

The further information and the fees must be filed with the Comptroller within fifty days from the first appearance of the notice in the local paper. The fees to be paid in respect of a licence for irrigation purposes are 5 cents per acre-foot of water applied for, and the annual rental is 2 cents per acre-foot of water granted by the licence.

Conditional Licence.—The Comptroller is now in a position to consider the application for the licence. If a "Class A" application, he may issue a conditional licence wherein he sets a time for the commencement and completion of the works and authorizes the use of the water.

SEVENTH STEP—(CLASS "B" APPLICANTS ONLY).

If a "Class B" application, he may issue an authorization to the applicant to proceed to survey and file plans and specifications of his proposed works, setting the time within which they must be completed and the manner in which they are to be made. These plans and specifications are to be submitted in triplicate, one set of plans being tracings and two sets prints, and must be in such detail that the construction of the works could be carried out from them.

EIGHTH STEP—THE TAKING OF LANDS.

Should the applicant require a right-of-way over Crown or private lands, the following procedure must be followed:—

Provincial Crown Lands.—Address a petition and sketch to the Minister of Lands, but file same with the Comptroller of Water Rights, showing:—

(1.) The number and principal terms of the conditional licence:

(2.) The nature of the easement required:

(3.) The length, breadth, and area of the right-of-way and its location.

Dominion Crown Lands.—Address a petition and sketch to the Minister of the Interior, but file same with the Comptroller of Water Rights, showing and setting out the same details as above.

Private Lands.—Obtain if possible the written consent of the owner of the lands over which a right-of-way is desired. If this is withheld it will be necessary for the applicant to furnish security to the amount set by the Comptroller, after which the Comptroller may give the applicant authority to enter on the lands to be used. Following this latter procedure, it is necessary for the applicant to take all steps necessary, as set out in the "Water Act," for the determination, by arbitration, of the amount which is to be paid by way of compensation for the land which is used.

NINTH STEP—FILING PROOF OF COMPLETION.

Within sixty days of the date set for the completion of the works, the licensee shall file proof of such completion, and the Comptroller, when he has satisfied himself by inspection or otherwise that the work has been carried out in a satisfactory manner, will issue a final licence.

While the above is an outline of the procedure to obtain a licence for the use of water, for full particulars of the rights and obligations of licensees interested parties are referred to the "Water Act, 1914," and the rules and regulations thereunder, copies of which, as well as detailed information and forms, may be obtained from the Comptroller of Water Rights, Victoria, B.C.

APPENDIX No. 3.

THE MEASUREMENT OF WATER.

The object in view in the administration of the water of British Columbia is to make the greatest beneficial use of the water, and in order to obtain this end the measurement of the water is of the greatest importance.

On most of the rivers of any size, and on many smaller streams, the measuring of the discharge is in the hands of expert engineers assisted by local observers, but the large body of the work necessary to obtain the greatest beneficial use must be done by the users themselves.

In most cases it is of advantage to know how much water there is, and how much any one is taking, as this leads to a great deal less trouble and friction where the water-supply is limited; it is also admitted that no one can really make a success of irrigation or utilize the important results made public in the reports of Government experimental work unless they know and can control the amounts of water used for different crops. It is hoped that the rather haphazard arrangements adopted by many irrigators will give place to more careful and studied methods.

It should be noted that by the "Water Act, 1914," 1 cubic foot per second (c.f.s.) is fixed as being equal to 1.98 acre-feet per twenty-four hours, so that 1 c.f.s. will approximately cover 1 acre to a depth of 1 inch in 1 hour; this forms an easy basis for calculation, and is used in the table in Appendix 7, which shows the acre-feet given by various discharges in cubic feet per second over a certain time.

The three main measuring-devices for small amounts of water are the "V" notch, the rectangular weir, and the Cippoletti weir. The "V" notch is useful only with very small amounts; the rectangular weir offers certain difficulties in calculation; but the Cippoletti weir overcomes these, it is simple to measure with, and is therefore adopted as being most suitable for the purpose in view.

How to make and place a Cippoletti Weir.

There are certain fundamental features in the construction and use of a Cippoletti weir that must be understood in order to obtain satisfactory results. It must be made correctly, placed correctly, and kept in good order.

Reference to the illustration will show that the sides of the opening are sloped 1 to 4; that is, for every 4 inches above the crest 1 inch is set off to the right or left.

The weir should be bevelled to a sharp edge on the up-stream face, so that the water passes freely over it and allows room for a small amount of air between the discharged water and the weir; sometimes a sheet of metal is used, and the weir cut out of that, or the wooden edge may be covered by a metal strip to prevent its being damaged and so losing its shape.

The following points should be carefully observed:—

(1.) The weir should be set at right angles to the stream, should be perpendicular, and the crest exactly horizontal.

(2.) The width from the edge of the slope to the bank should not be less than three times the depth of water flowing over the crest, so that if the weir is designed for a maximum discharge of 12 inches of water, there should be at least 3 feet clear to the bank each side.

(3.) The depth of water below the crest on the up-stream side should also be at least three times the depth of water passing over the crest, and arrangements should be made by a sluice-gate or otherwise to keep this depth clear.

(4.) There must be a free fall on the down-stream side.

(5.) It is important that as far as possible the water should approach the weir slowly, and without eddies or cross-currents. To obtain this, the weir should be placed in a straight length of channel where possible, and at such a height that a considerable pool is formed behind it.

How to measure the Discharge.

It will be noticed that where the water passes over the crest there is a slight curve in the upper surface, so to measure the correct depth it is necessary to place a peg from 6 to 10 feet from the weir, with the top exactly level with the crest, and to measure the water from the top of the peg; this depth is also called the head of water.

On referring to the table given, the head expressed in inches is shown on the left hand, and opposite this is given the discharge over a 1-foot weir. The discharge varies directly as the width of the crest, so for a 5-foot weir the figure given would be multiplied by 5, and similarly in any other case.

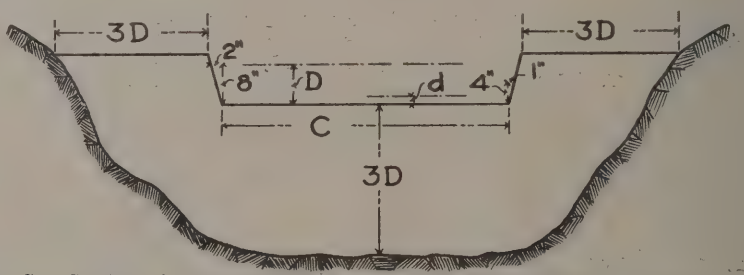
What Size to make the Weir.

To obtain good results from the use of Cippoletti weirs it is also necessary to keep the depth of water flowing over the weir within certain limits; this is obtained by varying the width to suit the particular requirements in each case. The depth of water should not be less than 2 inches, nor more than one-third of the length of crest; so within these limits a—

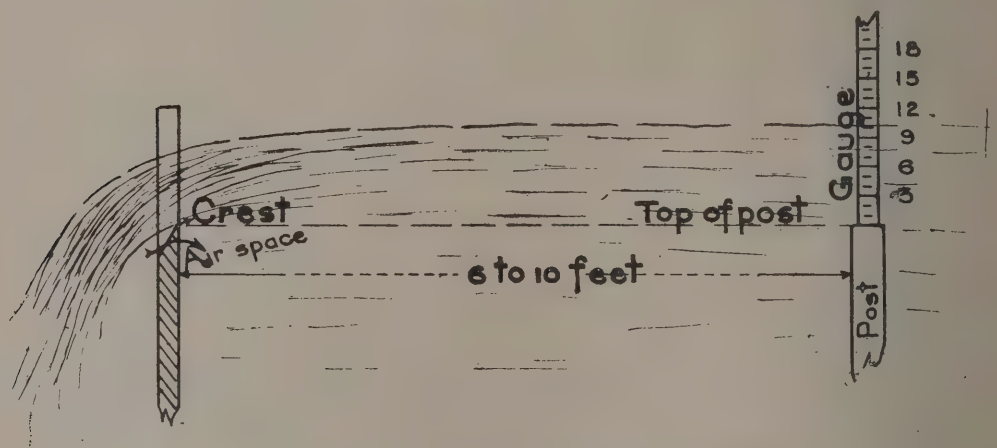
1-foot weir can be used for discharges from ¼ to 1 c.f.s.
2-foot weir can be used for discharges from ½ to 3½ c.f.s.
3-foot weir can be used for discharges from ¾ to 10 c.f.c.
4-foot weir can be used for discharges from 1 to 20 c.f.s.
5-foot weir can be used for discharges from 1¼ to 35 c.f.s.
6-foot weir can be used for discharges from 1½ to 55 c.f.s.
7-foot weir can be used for discharges from 1¾ to 80 c.f.s.
8-foot weir can be used for discharges from 2 to 115 c.f.s.
9-foot weir can be used for discharges from 2¼ to 155 c.f.s.
10-foot weir (with 2 to 36 inches depth of water) can be used for discharges from 2½ to 175 c.f.s.
15-foot weir (with 2 to 36 inches depth of water) can be used for discharges from 3½ to 260 c.f.s.
20-foot weir (with 2 to 36 inches depth of water) can be used for discharges from 4¾ to 350 c.f.s.

It will be seen there may be a considerable choice as to size, but it is best to select the one that will give the most correct measurements at the lowest discharge. The width of the watercourse and the grade will also influence the size of weir-crest.

Any inquiries as to the width most suitable in any particular case should be addressed to the Comptroller of Water Rights, giving full particulars as to width of channel, height and nature of banks, grade of watercourse, and the range of discharge required to be measured.



Cippoletti weir. C = Crest, or length of weir. D = Maximum depth of water on crest = one-third length of crest, but not more than 3 feet. d = Minimum depth of water on crest = 2 inches.



Cippoletti weir. C = Crest, or length of weir. D =

Table of Discharges in Cubic Feet per Second over a Cippoletti Weir One Foot wide.

Head in Inches.	Discharge in C.F.S.	Head in Inches.	Discharge in C.F.S.	Head in Inches.	Discharge in C.F.S.
1	0.08	4⅝	0.81	10½	2.75
1⅛	0.10	4¾	0.84	10¾	2.85
1¼	0.11	4⅞	0.87	11	2.95
1⅜	0.13	5	0.91	11¼	3.05
1½	0.15	5⅛	0.94	11½	3.15
1⅝	0.17	5¼	0.97	11¾	3.26
1¾	0.19	5⅜	1.01	12	3.37
1⅞	0.21	5½	1.04	12¼	3.47
2	0.23	5⅝	1.08	12½	3.57
2⅛	0.25	5¾	1.12	12¾	3.68
2¼	0.27	5⅞	1.15	13	3.79
2⅜	0.30	6	1.19	13¼	3.90
2½	0.32	6¼	1.26	13½	4.02
2⅝	0.34	6½	1.34	13¾	4.13
2¾	0.37	6¾	1.42	14	4.24
2⅞	0.40	7	1.50	14¼	4.35
3	0.42	7¼	1.58	14½	4.47
3⅛	0.45	7½	1.66	14¾	4.58
3¼	0.47	7¾	1.75	15	4.70
3⅜	0.50	8	1.83	15¼	4.82
3½	0.53	8¼	1.92	15½	4.94
3⅝	0.56	8½	2.01	15¾	5.06
3¾	0.59	8¾	2.10	16	5.18
3⅞	0.62	9	2.19	16¼	5.30
4	0.65	9¼	2.28	16½	5.42
4⅛	0.68	9½	2.37	16¾	5.55
4¼	0.71	9¾	2.46	17	5.68
4⅜	0.74	10	2.56	17¼	5.80
4½	0.77	10¼	2.66	17½	5.93
...	...	...	...	17¾	6.06
...	...	...	...	18	6.18

APPENDIX No. 4.

GRIZZLY BAR, OR SELF-CLEANING INTAKE AND DIVERSION.

Specification.—The box, which should be constructed of not less than 2-inch lumber, to be set in a trench cut across the creek, the top of box being flush with creek-bed. Box to be 2 feet wide by 1 foot 6 inches deep at shallow end, sloping to 2 feet deep where it terminates at the sluice-gate, at the connection to the flume. The length to be determined by local conditions, but should be only sufficiently long so that the sluice-gate and flume thereto can be conveniently located. Wing-boards and aprons of substantial size, depending on the particular site where the box is installed, to be provided, great care being exercised that the foot-steps are sunk sufficiently deep to avoid the possibility of the water getting underneath the box.

Grizzly bars to be fixed across top of box, the sides of the box being so shaped that the bars in the centre of the stream will be lower than those at the side. The middle 3 feet of bars to be sunk 1 inch lower than the sides in order that two pieces of ⅛-inch sheet iron or steel, each 2 feet by 1 foot 6 inches, may be set therein. These plates to be set prior to the spring floods, so that the greater quantity of water and gravel passing down the creek may be carried over the box and so prevent it choking.

A sluice-gate to be provided and fixed on the side of the lower end of the box, in order that all gravel and sand may be automatically discharged through a flume to the creek at a point below the grizzly bars.

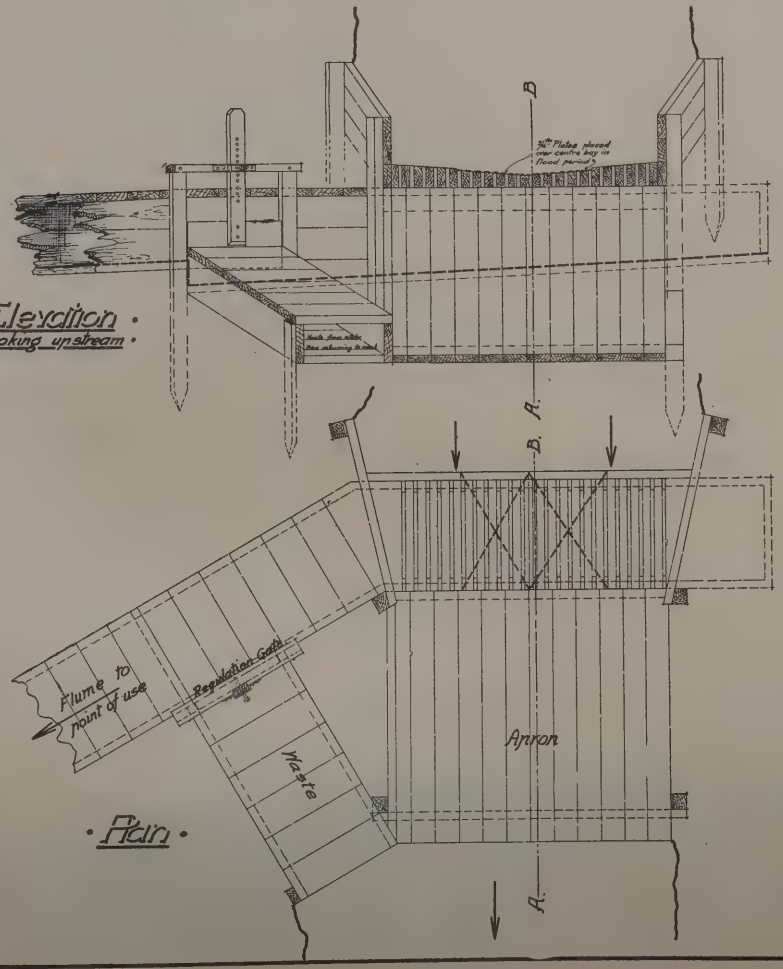
PROVINCE OF BRITISH COLUMBIA

Lands Department Water Rights Branch

GRIZZLY BAR OR SELF CLEANING INTAKE

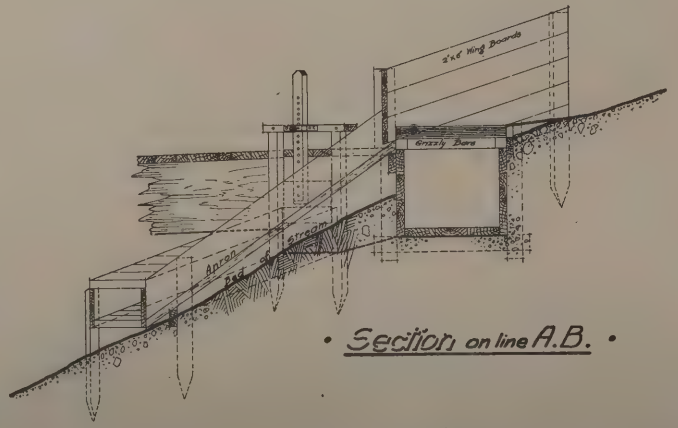
for Mountain Creek

Scale one inch = one foot



Elevation looking upstream

Plan



Section on line A.B.

W.J.E. Baker
District Engineer
NELSON
Dec. 1918

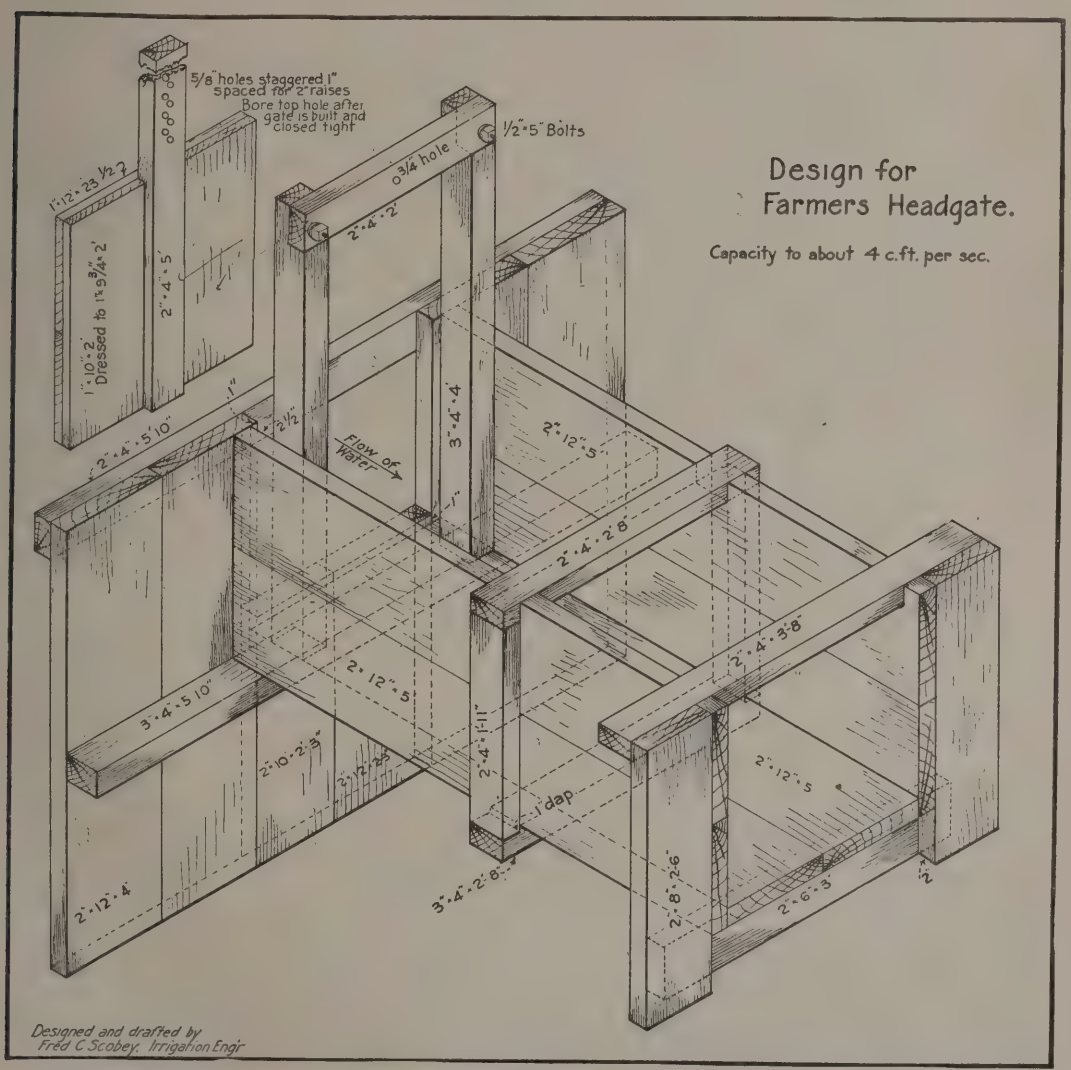
APPENDIX No. 5.

IRRIGATION HEADGATES.

Farmer's Headgate.

The farmer's small headgate shown in Fig. 1 will deliver up to 4 second-feet in the ditch below under favourable conditions of grade and size, assuming the gate-box can be kept full of water.

It will be noticed that the two inner planks of the front wings extend 1 inch beyond the inner face of the side-walls, thus forming front guides. The extension of the two planks in the front cut-off wall above the floor-boards by an inch makes a tighter gate; the gate fits down behind them.


Design for
Farmers Headgate.
Capacity to about 4 c.ft. per sec.
5/8" holes staggered 1" spaced for 2" raises
Bore top hole after gate is built and closed tight
1/2"x5" Bolts
0 3/4 hole
Flow of Water
1" dap
Designed and drafted by
Fred C Scobey, Irrigation Engr

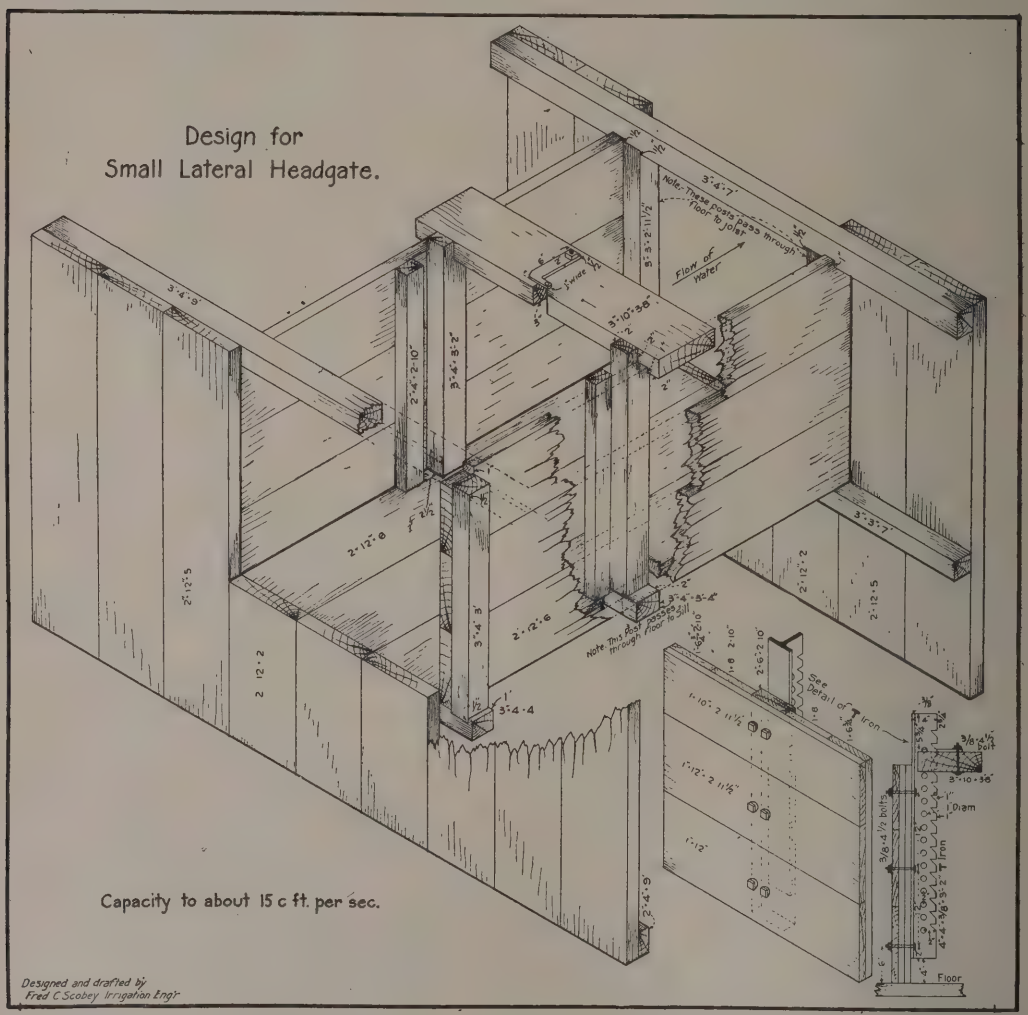
If possible, the stem of the gate should be hardwood and the holes bored therein staggered as shown; 5/8-inch holes will take a 1/2-inch pin, which could have an iron ring at one end and a small slot at the other to receive the tongue of a thin padlock.

The dimensions of lumber are suited to a structure of the size indicated; a considerable increase in size would need other dimensions and a rearrangement of struts and braces.

The depth of the wing and front walls must be determined by the nature of the soil; one of sand would require greater depth than those shown. Whatever depth be decided on, the dirt excavated must be well puddled round the walls, thoroughly tamped down with a rammer, previously having been worked to the consistency of stiff mortar. If the dirt be replaced in a dry state, carelessly shovelled in, there is every likelihood of a washout.

SMALL LATERAL HEADGATE.

The small lateral headgate shown in Fig. 2 is 3 feet high and 3 feet wide, with a capacity of about 15 second-feet under favourable conditions.


Design for
Small Lateral Headgate.
Capacity to about 15 c ft. per sec.
Designed and drafted by
Fred C Scobey Irrigation Engr

Should it be preferred, angle-iron can be used instead of a T-iron as a stem; it costs less. The gate is raised by means of a short crowbar inserted in the notches and used as a lever.

The same care should be taken to carefully install this type of gate as the farmer's small headgate; if necessary, the vertical planks of the wing-wall can be driven down with a wooden mallet, and cut to length after.

Timber should be notched and fitted as shown in the drawings; whilst this entails slightly more labour at the time, it adds a great deal to the strength and stiffness of the structures.

Bills of material for both types of gates are appended; the lateral type has quantities for three sizes.

Farmer's Headgate. Capacity up to about 4 Second-feet (depending on Grade and Condition of the Ditch below the Gate).

Bill of Lumber.

Use.	Pieces.	Dimensions.	Feet, B.M.
Side boards	4	2″ x 12″ x 5′	40
Floor	2	2″ x 12″ x 5′	20
Front wings	4	2″ x 12″ x 4′	32
Front cut-off wall	1	2″ x 12″ x 2′ 3″	5
„ „ „	1	2″ x 10″ x 2′ 3″	4
Cap	1	2″ x 4″ x 5′ 10″	4
Joist	1	3″ x 4″ x 5′ 10″	6
Gate-posts	2	3″ x 4″ x 4′	8
Cap for gate-posts	1	2″ x 4″ x 2′	1
Sill	1	3″ x 4″ x 2′ 8″	3
Cap	1	2″ x 4″ x 2′ 8″	2
Posts	2	2″ x 4″ x 1′ 11″	3
Lower wings	2	2″ x 12″ x 2′ 6″	10
Cut-off sill	1	2″ x 6″ x 3′	3
Cap	1	2″ x 4″ x 3′ 8″	3
Bolts	2	½″ x 6″	..
Gate-stem	1	2″ x 4″ x 5′	3
Gate-boards	2	1″ x 12″ x 23½″	4
„	2	1″ x 10″ x 2′	4
		Total feet, B.M.	155

Two bolts ½″ x 5″, with washers for each end.

Headgate for Small Lateral. Capacity up to about 15 Second-feet (depending on Grade and Condition of the Lateral below Gate).

(As per Plans in Drawing. Bottom, 3 feet wide; sides, 3 feet high.)

Bill of Lumber.

Use.	Pieces.	Dimensions.	Feet, B.M.
Side boards	6	2″ x 12″ x 6′	72
Floor	3	2″ x 12″ x 6′	36
Front wings	6	2″ x 12″ x 5′	60
Front cut-off wall	3	2″ x 12″ x 2′	12
Joist	1	2″ x 4″ x 9′	6
Sill	1	3″ x 4″ x 4′	4
„	1	3″ x 4″ x 3′ 4″	4
Posts	2	3″ x 4″ x 3′	6
Cap (front wings)	1	3″ x 4″ x 9′	9
Lower wings	4	2″ x 12″ x 5′	40
Lower cut-off wall	3	2″ x 12″ x 2′	12
Joist	1	3″ x 3″ x 7′	5
Posts	2	3″ x 3″ x 2′ 11½″	5
Cap	1	3″ x 4″ x 7′	7
Front guides	2	2″ x 4″ x 2′ 10″	4
Rear guides	2	3″ x 4″ x 3′ 2″	6
Foot-plank	1	3″ x 10″ x 3′ 8″	10
Gate-boards	1	1″ x 10″ x 2′ 11½″	3
„	2	1″ x 12″ x 2′ 11½″	6
„	2	1″ x 8″ x 2′ 10″	4
„	2	1″ x 6¾″ x 2′ 10″	4
„	1	2″ x 6″ x 2′ 10″	3
		Total feet, B.M.	318

T-iron—One piece 4″ x 4″ x ⅜″ x 3′ 2″, bored as per detail.
Bolts—Seven ⅜″ x 4½″, with washers for each end.

HEADGATE FOR SMALL LATERAL. CAPACITY UP TO ABOUT 20 SECOND-FEET (DEPENDING ON GRADE AND CONDITION OF THE LATERAL BELOW GATE).

(As per Plans in Drawing, except 4 feet wide instead of 3 feet wide.)

Bill of Lumber.

Use.	Pieces.	Dimensions.	Feet, B.M.
Side boards	6	2″ x 12″ x 6′	72
Floor	4	2″ x 12″ x 6′	48
Front wings	6	2″ x 12″ x 5′	60
Front cut-off wall	4	2″ x 12″ x 2′	16
Joist	1	2″ x 4″ x 10′	7
Sill	1	3″ x 4″ x 5′	5
,,	1	3″ x 4″ x 4′ 4″	5
Posts	2	3″ x 4″ x 3′	6
Cap (front wings)	1	3″ x 4″ x 10′	10
Lower wings	4	2″ x 12″ x 5′	40
Lower cut-off wall	4	2″ x 12″ x 2′	16
Joist	1	3″ x 3″ x 8′	6
Posts	2	3″ x 3″ x 2′ 11½″	5
Cap (lower wings)	1	3″ x 4″ x 8′	8
Front guides	2	2″ x 4″ x 2′ 10″	4
Rear guides	2	3″ x 4″ x 3′ 2″	6
Foot-plank	1	3″ x 10″ x 4′ 8″	13
Gate-boards (front)	1	1″ x 10″ x 3′ 11½″	4
,, ,,	2	1″ x 12″ x 3′ 11½″	8
,, (back)	2	1″ x 10″ x 2′ 10″	5
,, ,,	2	1″ x 10¾″ x 2′ 10″	5
,, ,,	1	2″ x 6″ x 2′ 10″	3
		Total feet, B.M.	352

T-iron—One piece 4″ x 4″ x ⅜″ x 3′ 2″, bored as per detail.
Bolts—Seven ⅜″ x 4½″, with washers for each end.

HEADGATE FOR LATERAL. CAPACITY UP TO ABOUT 28 SECOND-FEET (DEPENDING ON GRADE AND CONDITION OF LATERAL BELOW GATE).

(As per Plans in Drawing, except 4 feet wide and 4 feet high instead of 3 feet wide and 3 feet high. Cut-off and wing-walls 1 foot deeper.)

Bill of Lumber.

Use.	Pieces.	Dimensions.	Feet, B.M.
Side boards	8	2″ x 12″ x 6′	96
Floor	4	2″ x 12″ x 6′	48
Front wings	6	2″ x 12″ x 7′	84
Front cut-off wall	4	2″ x 12″ x 3′	24
Joist	1	2″ x 4″ x 10′	7
Sill	1	3″ x 4″ x 5′	5
,,	1	3″ x 4″ x 4′ 4″	5
Posts	2	3″ x 4″ x 4′	8
Cap (front wings)	1	3″ x 4″ x 10′	10
Lower wings	4	2″ x 12″ x 7′	56
Lower cut-off wall	4	2″ x 12″ x 3′	24
Joist	1	3″ x 3″ x 8′	6
Posts	2	3″ x 3″ x 3′ 11½″	7
Cap (lower wings)	1	3″ x 4″ x 8′	8
Front guides	2	2″ x 4″ x 3′ 10″	5
Rear guides	2	3″ x 4″ x 4′ 2″	8
Foot-plank	1	3″ x 10″ x 4′ 8″	13
Gate-boards (front)	1	1″ x 10″ x 3′ 11½″	4
,, ,,	3	1″ x 12″ x 3′ 11½″	12
,, (back)	2	1″ x 10″ x 3′ 10″	7
,, ,,	2	1″ x 10¾″ x 3′ 10″	7
,, ,,	1	2″ x 6″ x 3′ 10″	4
		Total feet, B.M.	448

T-iron—One piece 4″ x 4″ x ⅜″ x 4′ 2″, bored as per detail (for additional foot).
Bolts—Seven ⅜″ x 4½″, with washers for each end.

APPENDIX No. 6.

OVERIRRIGATION.

Overirrigation:—

(1.) Causes smaller crop yields per unit of water:
(2.) Encourages water-logging and alkali trouble on heavy or low-lying land:
(3.) Leaches out plant-food from coarse soils:
(4.) Causes more plant-food to be used by the plant for each pound of crop produced:
(5.) Causes the quality of crops to be reduced:
(6.) Produces straw at the expense of grain:
(7.) Deprives other lands of irrigation-water:
(8.) Soil air is excluded and unfavourably low soil temperatures are caused by excessive irrigation:
(9.) The community spirit is lower wherever water is wastefully used:
(10.) Overirrigation is the greatest menace to permanently profitable irrigation agriculture:

Proper irrigation makes it possible to build up and keep the soil in a higher state of fertility than is possible by other types of farming.

APPENDIX No. 7.

USEFUL DATA.

1 mile = 1,760 yards = 5,280 feet = 80 chains.
1 chain = 100 links = 66 feet = 4 rods.
1 square mile = 640 acres.
1 acre = 43,560 square feet = 10 square chains.
1 acre equals approximately a square 209 x 209 feet.
1 foot per second = 0.68 mile per hour.
1 mile per hour = 1.467 feet per second.

WATER UNITS.

1 cubic foot of water = 6.23 gallons.
1 cubic foot of water weighs 62.4 lb.
1 cubic foot per second = 6.23 gallons per second.
= 373.9 gallons per minute.
= 538,453 gallons per day of 24 hours.
= 35.71 B.C. miners' inches.
= 1.98 acre-feet per day of 24 hours.
1 miner's inch = 0.028 cubic foot per second.
= 10.47 gallons per minute.
= 15,076.8 gallons per day.
= 0.0555 acre-foot per day.
= 1 acre-foot in 18 days of 24 hours.
1 acre-foot = 43,560 cubic feet.
= 271,472 gallons.
= 1 cubic foot per second for 12.12 hours.
= 1 miner's inch for 432.86 hours.
1 gallon = 277.274 cubic inches.
= 0.16046 cubic foot.
= 1.2 U.S. gallons.
= 10 lb.
1,000,000 gallons = 160,460 cubic feet.
= 3.68 acre-feet.
= 1.86 cubic feet per second for 1 day.
= 66.3 miners' inches for 1 day.
1 horse-power = 550 foot-pounds per second.
= 1 cubic foot of water falling 8.8 feet in 1 second.
= 746 watts.
= 0.746 kilowatt.

To calculate horse-power at 70 per cent. efficiency, multiply the amount of flow of water expressed in cubic feet per second by the available head in feet by the factor 0.08.

To convert head in feet into pounds pressure per square inch, multiply by 0.434.

To convert pounds pressure per square inch into head in feet, multiply by 2.31.

DUTY OF WATER.

From 1 to 3 acre-feet of water, depending upon the kind of crop and the rainfall in the particular locality, is usually considered sufficient to properly irrigate 1 acre of land. One acre-foot of water properly distributed over an acre of land is equal to 12 inches of rainfall.

The majority of water licences in the Dry Belt of British Columbia, where the precipitation is less than 20 inches per annum, allow the use of 2½ acre-feet of water to each acre of land.

From 3 to 5 acre-inches is generally considered sufficient for each irrigation, depending on the kind of crops and the method employed in irrigating. This would allow (when using 2½ acre-feet per acre) six to ten irrigations during the season.

Note.—The gallons referred to above are Imperial gallons. Care should be taken when figuring on pump capacities to note whether Imperial or U.S. gallons are referred to, as a U.S. gallon is only 0.833 of an Imperial gallon. The cubic foot per second is the unit of measurement for flowing water, while the acre-foot is used for the measurement of water in bulk, such as capacity of reservoirs, the total quantity of water which may be used during the irrigation season, etc. The miner's inch referred to above *was* the legal unit of measurement in British Columbia prior to the year 1909.

Table showing Acre-feet given by Various Discharges over a Certain Time.

Discharges in Acre-feet for Various Flows for given Time Periods.

	6 Hours.	12 Hours.	1 Day.	1½ Days.	2 Days.	2½ Days.	3 Days.	3½ Days.
½ c.f.s.	¼	½	1	1½	2	2½	3	3½
1 „	½	1	2	3	4	5	6	7
2 „	1	2	4	6	8	10	12	14
3 „	1½	3	6	9	12	15	18	21
4 „	2	4	8	12	16	20	24	28
5 „	2½	5	10	15	20	25	30	35
6 „	3	6	12	18	24	30	36	42
7 „	3½	7	14	21	28	35	42	49
8 „	4	8	16	24	32	40	48	56
9 „	4½	9	18	27	36	45	54	63
10 „	5	10	20	30	40	50	60	70

VICTORIA, B.C.:
Printed by William H. Cullin, Printer to the King's Most Excellent Majesty,
1919.

PROVINCE OF BRITISH COLUMBIA

REPORTS

OF

THE BOARD OF TAXATION

Appointed under the Provisions of the
"Board of Taxation Act"

WITH A

REPORT ON TAXATION

IN THE PROVINCE OF

BRITISH COLUMBIA

BY

ROBERT MURRAY HAIG, PH.D.

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

To His Honour Sir Frank Stillman Barnard, K.C.M.G.,

Lieutenant-Governor of the Province of British Columbia.

May it please Your Honour:

The undersigned has the honour to present Reports of the Board of Taxation appointed under the provisions of the "Board of Taxation Act," chapter 64, Statutes of 1917.

All of which is respectfully submitted.

JOHN HART,

Minister of Finance.

Treasury Department,

Victoria, March 1st, 1919.

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FIRST REPORT

OF THE

BOARD OF TAXATION.

To the Honourable John Hart,
Minister of Finance.

SIR,—We, the members of the Board of Taxation, appointed by minute of Council approved by His Honour the Lieutenant-Governor on November 2nd, 1917, under the provisions of the "Board of Taxation Act," beg to report the result of our investigations in the recommendations embodied herein.

It would not be seemly in us, and indeed would be doing a wrong to our feelings, if we did not record at the outset the deep regret we feel and our sense of the loss we suffered in the death of our able and esteemed Chairman, J. B. McKilligan, whose death has removed from the service of the Government a most capable officer, and taken from this Board an unequalled source of knowledge of the history and methods of taxation acquired by him in his many years of service as Surveyor of Taxes in this Province.

His loss made the work of this Board very difficult, the more especially that up to the time of his death the duties of his office as Surveyor of Taxes gave him little time for the work assigned to this Board, and with the exception of performing the duties of Chairman at the meetings held to hear the evidence and pleas of delegations which appeared before the Board on matters concerning them in regard to taxation, the help given us by him was very indefinite and limited in scope; and, as you are aware, no one has been appointed to take his place, and no secretarial help has been asked for by this Board.

On November 5th, 1917, the Board held its first meeting and passed a resolution to fix the time of its meetings—viz., to meet and sit from 10 o'clock a.m. to 5 o'clock p.m. on Mondays, Tuesdays, Wednesdays, Thursdays, Fridays, and from 10 o'clock a.m. to 1 o'clock p.m. on Saturdays. The terms of that resolution have been closely observed, and the transcript of the evidence herewith submitted reveals the time in hearing that evidence. Beyond the evidence therein shown and the privilege afforded us to be present at hearings given by the Executive to representatives of mining and other interests, there has been little added by written documents, as will be shown by the files thereof, herewith also submitted.

Professor Haig, who was present to hear the evidence, acting in the capacity of a special and expert adviser to your Department, worked apart from this Board, and his report, received on March 15th, after the most important conclusions of this Board herein contained had been reached, will be referred to in this report either to show our concurrence with his conclusions where we agree, or our reasons for differing from them where we do not agree therewith.

In addition to the knowledge brought by the members of this Board to the performance of the work imposed upon it by the "Board of Taxation Act," each member, in accordance with the directions laid down therein, has investigated and studied the reports of Tax Commissions and similar bodies in this and other Provinces of the Dominion of Canada, in other parts of the British Empire, in the United States and elsewhere, and in particular such reports from places and countries where new and approved methods of taxation have been introduced, to the extent permitted by the short time given us since our organization.

Before proceeding to review the present economic conditions of this Province, in so far as these relate to and indicate the ability of the different classes of the population to pay taxes, it will be relevant, for the purpose of comparison, to refer to the condition of the Province in 1911 as reflected by the Royal Commission on Taxation in its report dated January 19th, 1912.

On the condition of the Province at the time the Commissioners made their inquiries and took evidence on which to base their report, they were able "to point out that they found abundant proof of rapidly advancing prosperity side by side with a strong spirit of optimism on the part of the people," and "wherever complaints came to the surface it was observable that they were complaints regarding the methods rather than the amount of taxation." This

opinion is emphasized in the summary of that report which proves its deep impression. How far this seeming prosperity and expression of optimism influenced that Commission in reaching its decision is not for this Board to judge, but we wish to say that its very able report, as well as that of the Commission which sat in 1905, has been read and studied with much interest and, we hope, with some advantage to guide us in our work, and we are conscious that the high literary style of both these reports will show this one, by comparison, very defective in that respect.

Without reflecting on the prescience or perspicacity of the members of the Commission of the later date, or of the people whose evidence gave them the impression of the prosperity of the Province and the prevalent spirit of optimism, this Board, in the light of what has taken place since that time, regrets to have to say that the prosperity that seemed so certain then was not of long duration, and that the optimism expressed has been deprived of some of the foundations on which it rested. Time has shown that much of the prosperity which existed at that period did not arise from the production of wealth, which is the true basis and evidence of real prosperity, but arose from the spending of capital. Unfortunately, a very large part of such capital was misdirected or wasted by being invested on a basis of false values or in non-revenue-producing undertakings. And, to add to the misfortune, a large part of the capital so misdirected and wasted was borrowed money.

In less than a year after the date of the report of the Commission of 1911-12 the reaction had begun, as is indicated in a general way by the Royal Commission on Agriculture in 1913. From that time the exodus of the people from this Province was very large up to the time the war broke out, and many more would have gone had they had the means to do so. Luckily, a large number of those who left returned to the Prairie Provinces, whence they came, and so saved their energies, if not their money, for the development of our own country.

The intensity of the depression which followed the false prosperity of the "land boom" increased until the beginning of the war, when patriotism for the Empire, which in many cases was quickened to action by low finances, led most of the men who were physically fit to join the army, thereby, incidentally, relieving the hardships arising from non-employment. This, with the large expenditure of Federal money within the Province for war purposes, which has continued to flow into it ever since, relieved the general business depression and saved it from a probable financial collapse. Concurrently with the "land boom" in this Province there was running a "boom" in the Prairie Provinces also, but unlike ours, in that it was confined mostly to cities and towns. The building resulting from these combined "booms" gave a great impetus to our lumber industry, which reached large proportions in 1913, but which, in sympathy with the collapse of the land speculation, shrank very materially and left little to support the general business of the Province other than the shingle-mills, mining, fishing, and farming industries.

The expenditure by the Federal Government, made necessary by the war, has led to the revival of the lumber industry, which now is in an expanding and prosperous condition, and the output of the metalliferous mines has, under the stimulus of increased prices and unlimited demand created by the war, helped very largely in improving and supporting the commercial life of the community.

How far the abnormal conditions which arose and followed each other in this Province before the war in such a short period of time were the result of the policy of the Government is not a matter for this Board to inquire into, nor to express an opinion upon, but it has evidence to show that many taxpayers are in a position to realize the truth expressed by Dr. Adam Shortt, that "their economic life is being crushed between the millstones of collapsing land-values and rising taxes." But this Board may take this opportunity to say that to it the most inexplicable part of the strange economic phenomena referred to is that no individual or body of men, no financier, no Board of Trade or other body, not even the press or any one else to whom the people might look to for guidance, raised a note of warning during that whole spasm of wild riot of borrowing and spending. On the contrary, some of our big financial institutions and public corporations "set the pace and led the race" in establishing false values.

This being the case, it is no wonder that the wage-earner, the man on the street, and even farmers, who should know better, lost all sense of proportion in respect to land-values.

It is a pity that some one with the wisdom of Dr. Adam Shortt did not have the power to stop all this wild orgy of speculation. Even now there are those amongst us who say that if capital is brought in and spent, no matter how, even if it is wasted, it is a benefit, in spite of

the teaching of our best economists, who show, as experience teaches, that capital squandered or misdirected is harmful, since it directs labour into channels of employment that cannot be permanent and are destructive rather than productive of wealth.

The conditions in the Province when the war broke out may be summarized as follows: Highly inflated real-estate values, heavy indebtedness resulting from reckless borrowing by the Government, municipalities, and private individuals, all of which led to wasteful expenditure and a misdirection of the energies of the people. It is estimated that more than two-thirds of the people were living in cities or the suburbs of cities, most of whom were depending on an increase of real-estate values to recoup their investments and to bring in a revenue to live on. The reaction came and thoroughly demoralized the community commercially and industrially, except in the lines above mentioned. The war relieved the situation, at least temporarily, but the debts remain, and the real-estate values are sought to be maintained by the owners except for purposes of taxation.

This review of the history and present condition of the Province, prompfed by the remarks of the Royal Commission on Taxation in 1911 on its condition at that time, might be amplified and the facts emphasized by quotations from evidence from many sources, and is made for the purpose of showing a basis, and, in some degree, to justify some of the opinions and recommendations herein contained, especially in respect to land-values and the taxation thereof.

This Board, keeping in mind the duties prescribed for it by the "Board of Taxation Act," when investigating the present system of Provincial taxation and the taxation laws of the Province, and comparing these with the principles and methods of taxation in the other Provinces of Canada and other countries, has kept in view, also, the conditions in this Province arising from its *newness*, its resources, the stages of their development, and the distribution and character of its inhabitants, in order to realize the similarities to and differences from the conditions, resources, and population of the various countries with whose systems the taxation of this Province has been compared.

This Board recognizes the fact that comparative "ability to pay," which is the just guide in taxation, may not have the same basis for measurement as between the several classes in different communities. For instance, "ability to pay" in an old, highly organized, and densely populated country will have a different basis for measurement from that of new and sparsely populated ones. In a new country like this, where population is sparse and natural resources still open for appropriation by individuals, and where in consequence there is no circumscribed area out of which it is difficult for the wage-earning class to get, such as exists in old countries, comparative "ability to pay" may indicate the justice of levying a portion of the revenue required by the Government on a lower stratum of economic units of the population than could be justified in the older communities. For, as Adam Smith pointed out in respect to the then American Colonies, cheap land brought cheap food and high wages, and that condition should obtain in this Province under natural development.

When Adam Smith wrote, the Eastern part of this continent was being developed in what may be called the natural way—developing first the agricultural resources and slowly accumulating capital to be applied later on for industrial undertakings. In that period the farmers lived mostly on what they grew on their farms, and, indeed, produced within their own homes most of their clothing and bought very little of commercial goods. The same process of development was taking place on this Coast, as the early history of Oregon will show, when a new and disturbing factor to that process was introduced by the discovery of gold in California and by a similar event in British Columbia about ten years later. This led to a reversal of the order of development which took place on the Eastern side of the continent, for in California agricultural development followed rather than preceded other development, because gold-mining raised wages for a time far above any scale of wages that farming could afford. But this was only for a short time, as her rich lands soon attracted the less adventurous souls and those whose first attempts at mining were unsuccessful, which soon brought her agricultural production up to a point where it not only supplied her own population, but left large quantities for exportation.

In British Columbia the reversal was still more marked and still continues, for we are, up to the present, far from raising enough farm products for our own consumption, and this Province cannot hope to succeed in developing widely on the many lines of production for which she has raw material without the first pre-requisites—namely, cheap food and consequent lower wages.

In following, further, the example in the report of the Royal Commission of 1911, this Board hopes it will not appear superfluous for it to refer to some of the principles underlying taxation as set forth by students of political economy, of which science taxation is a very important branch.

Political economy is defined as that part of science which investigates the production and distribution of wealth, and wealth may be defined as those things produced by mankind that yield to individuals the support and comforts of life. Adam Smith, first eminent writer in English on political economy, in the opening sentence of his great work, discloses to us the first and most important factor in the production of wealth—viz., labour. He says: "The annual labour of every nation is the fund which originally supplies it with the necessary conveniences of life which is annually consumed, and which consists always in the immediate produce of that labour or what is purchased with it from other nations."

He shows also that the desire and ability to exchange commodities gave rise to the division of labour, and that in turn to the accumulation of the products of labour, which is called capital, and which is the great artificial factor in the production of wealth. He further traces the process of the ever-increasing growth of the power to produce wealth by the combined and organized application of labour and capital to the materials supplied by nature; all of which is by political economists included in the term "land." But in the desire and ability to exchange commodities, which has, as shown, led up to the enormous production of wealth such as we see to-day, lay also the germ of the inequality of its distribution, thereby adding to the inequalities in everything which nature produces, even in mankind, both in her kindness and in her cruelties.

The inequalities in the distribution of wealth which a nation produces divides its people into classes by raising them into many grades above the general low level, of nearly equal conditions, that obtained among mankind in a state of barbarism. And the measure of these inequalities is determined by the difference in the ability, however got or possessed, of the individual, as compared with other individuals, to draw to himself from the fund of wealth produced by the whole people, either in the process of its production or in its distribution, or in both. This inequality in the distribution of wealth which gives rise to the accumulation of its surplus that is not needed for immediate consumption, or prevents it from being consumed, so that it can be used as capital in further production, is a matter occupying the thoughts of economists and sociologists as to whether or not social and economic progress will evolve some other method by which the surplus production, now drawn into the hands of a limited class, can be saved and accumulated more equitably and economically for the community.

This is a matter for the future to solve, and that it will be solved is the hope of many. But those who clamour for it most have shown little inclination or ability to organize to take advantage of their own power, by co-operation, to modify if not eventually break down the power of the few to draw into their own hands so large a portion of the wealth produced by the nation. Until those who are so loud in their condemnation of the present system show some evidence of that ability to organize and co-operate, which implies and depends on faith in each other, it is not likely that the rest of the community will jump from the tried, nothwithstanding all its evils, to the untried, but will seek rather to eliminate those evils by gradual steps. Experience has shown that great changes, to be safe and permanent, can only be brought about by slow transitions.

With the history of the production and distribution of wealth is closely interwoven the history of the methods which have been used by Government to draw from the people that portion of the nation's revenue which is needed by every Government to carry out its functions. It is not necessary here to trace closely the changes in the methods of taxation shown in history from the "first stage of rude equality in the poll-tax"; then to the tax on cattle and lands, which were the tangible evidences of the possession of wealth; then to the different forms and evidences of wealth which have developed through higher organization of labour and capital to produce wealth, up to the present time, when the last stage somewhat resembles the first, in that Governments are looking to the individuals of the community to pay taxes in accordance with each one's "ability to pay," with that "ability to pay" measured by the amount each individual draws from the fund of wealth produced by the whole community—namely, net income.

This principle was laid down by Adam Smith when he said: "The subjects of every State ought to contribute to the support of the Government, as nearly as possible, in proportion to the revenue which they respectively enjoy under the protection of the State. In the observation

or neglect of this maxim consists the equality or inequality of taxation." This maxim has been approved by most of the writers on taxation, though some writers on political economy have tried to qualify it in one way or another; but as the power of legislation and taxation has been largely controlled by those whose revenue "which they respectively enjoy under the protection of the State" would have been materially lessened by its strict application, it has been slow in finding expression in law, and even when so expressed has been more or less evaded because of that lack of social conscience which John Stuart Mill so deeply deplored, in his time, in England, and it is an open secret that, until recently, the wealthy classes in the United States made their success in escaping taxation, a subject for cynical jest.

But in recent years a closer analysis of taxation has been made by the public in nearly all countries, and especialy in the United States, where a great change seems to have come "over the spirit of the dream" of the wealthy; whether from a dread of something worse happening than their having to pay a fair share of the cost of Government, or for some other reason more creditable to themselves, is a matter for conjecture. However, one of the leading economists of that country, Professor Seligman, speaks out, apparently with some hope of being heard, in these words: "Amid the clashing of divergent interests and the endeavour of each social class to roll off the burden of taxation on some other class, we discern the slow and laborious growth of standards of justice in taxation and the attempt on the part of the community as a whole to realize this justice. The history of finance, in other words, shows the evolution of the principle of faculty or ability in taxation—the principle that each individual should be held to help the State in proportion to his ability to help himself." And he says further: "To arrange a system of taxation which shall, on the whole, correspond as closely as possible to net revenue of individuals and social classes, and which shall take into account the variations in the taxpaying ability, has thus become the demand of modern civilization."

This is the demand which a majority of the people of this Province is making, and one which its Government is anxious to satisfy. The people of this Province must realize, however, that there is no source from which a nation's revenue can be produced other than by the application of labour to land (that is land in its widest meaning), except by robbery through war on other nations or by cheating them in trade, and these have always reacted in the long run against the nation which used such methods.

Another fact which should be kept in mind is that the person who cannot or will not help himself can pay no tax, and it is idle for any one to plead, whether he be wage-earner, farmer, manufacturer, merchant, or capitalist, that because his energies or his capital seem to be an important factor in the production of wealth he has good grounds to ask exemption or relief from taxation.

Yet one will often hear the plea: "I should not be penalized by being taxed for improving my land, or for building my house, or for bringing in and employing my capital." The absurdity of such a plea will appear when it is realized that the tramp can pay no taxes, nor the invalid, nor the imbecile, nor could the idle rich if they did not inherit stored-up labour from some one else.

Therefore, out of the product of the people's labour must be paid the cost of government, and that cost should bear some reasonable proportion to the amount of the wealth produced by the people. If a Government is extravagant or wasteful, it is drawing from its people capital which should be left in their hands to be employed in the production of more wealth. In every country this is an important matter, and is especially so in a new one. We take the liberty of referring to this matter because there was some very pointed criticism relating thereto made by some of those who appeared before this Board on matters affecting taxation, which indicates that the cost of government is being considered seriously by the taxpayers.

The sources of revenue in this Province seem many and various, but, with the exception of that part of it received from the Federal Government, it must all come through the economic units of the community, and these units are divided into classes by the nature of their economic activities as applied within the opportunities the community affords them for the exercise of those activities. These economic units may be classified as follows:—

(1.) Persons:
(2.) Persons having land under their control given them by the community; and
(3.) Persons employing capital for the purpose of making profit by its employment within the community.

In any one person may be combined any two or all of the above characteristics of these units, and, if so, then he may be taxed under any or all of those qualifications which he possesses.

(1.) TAX ON PERSONS.

At the present time there is a tax on some persons under the provisions of the "Poll-tax Act." This Board is aware of the fact that in nearly all civilized countries economic organizations have reached a point of development where, in the distribution of the wealth produced, the channels through which other classes can draw from the wage-earners nearly all but a bare living have been made so numerous and perfect that their Governments refrain from levying a direct personal tax upon those who work for wages, and it is only on such grounds as these that the exemption of any class of residents of a country from taxation can be justified.

This Board does not think that this condition has been reached in this Province, and surely there is no able-bodied man who will plead this as an inability to pay a poll-tax. We therefore recommend that the poll-tax be continued, and that its application be extended to all male residents between the ages of twenty and sixty years, without exception other than those who are exempt under subsections (*a*), (*b*), (*c*), and (*e*) of section 4 of the present Act. The Board is of opinion that the condition of this Province is such, in respect to the ability of all classes to pay and in respect to the need of revenue by the Government, as to justify and demand this. As soon, however, as the conditions above referred to become so changed as to permit of this tax being abolished, we recommend that it be discontinued.

(2.) TAXES ON PERSONS (INCLUDING CORPORATE BODIES) WHO HOLD LAND.

This Board would discuss under the heads of those who hold land (*a*) for use, and (*b*) for speculation.

Lands held for use may be divided into the following classes:—

(1.) Lands held for agricultural and horticultural purposes:
(2.) Lands held for mining purposes:
(3.) Lands held for and as timber lands:
(4.) Lands held for building purposes:
(5.) Lands held for an increase in value to come from the increase of population and the wealth created by that factor.

In dealing with Class (1) as a source of revenue, we submit the following as an analysis of the factors and conditions which should determine the valuation of agricultural and horticultural lands for the purpose of taxation:—

When a person gets control of a piece of land, as nature presents it, for agricultural use, he directs his energies to making whatever improvements may lead to that end, by putting up buildings, clearing, draining, etc., and the undertaking presupposes he has enough capital to maintain him and pay taxes until he gets it to a stage of development to do so.

He has a double object in view; First, to get a living therefrom; and, second, to store up a certain amount of capital—surplus labour—in the land until it reaches the normal limit of its productiveness. The capital value being so stored up at any stage of the process of development will be measured by the difference between what it costs him to grow and take his produce to market and the price he gets for it. If the last is greater than the first, the difference will be the interest he is getting on his stored-up capital, and will express the rental value of his property at that stage.

There are other factors generally acting to add to the value created by himself, and these in new countries are usually very material—namely, the roads and other improvements made by the community and the growth of the community itself.

Between the time he begins upon his land and the time he has brought it up to a point of productiveness at which it will support him and pay taxes, the difference between his expenses and his income must be paid out of capital drawn from some other source than this land, and this capital is invested in it on the faith of its prospective value. This indicates that the amount of taxes levied by the Government on this land at any point in the initial stage of its development must be levied not on its value at that point, but on its prospective value, and can find justification only on the grounds that the general development of the country by public improvement and the growth of the community is a material factor in giving value to his holding and adding to his "power to pay." Until the time his holding reaches a stage of productiveness which affords

him a living and pays taxes the valuation for taxation must be arbitrary and speculative, but when it does reach that stage, then the true basis for taxation has been established—namely, its rental value.

There is in the mind of some people the idea that there is no limit to the increase of the value of farm lands; that their value keeps on increasing in the way in which city property increases, and that there is a sort of alchemy about farm production; but this is easily dissipated by experience, and to some it is a very costly experience. In human affairs it is necessary to bring in the law of average to arrive at some values, and this applies very fittingly to the valuation of farm lands.

The average value of farm lands under normal conditions, and when prices are normal, is determined by the comparative natural productiveness of the soil to grow those crops which form the staple foods of the community, such as wheat, oats, vegetables, and meats. This criterion may seem disturbed by special circumstances or conditions over certain areas or for short periods of time, but taking any country as a whole and over a long period of time the average will be found. Some parcels of land will be above or below the average, partly because of their soil being rich or poor, or being near to or far from market, or other factors bearing unequally upon them; but the comparative value of each will be its rental value, and that, capitalized, will determine its sale value.

Its rental value is, therefore, the measure of the income of its owner from it, or the measure of the rate of interest he is getting on his investment, as well as the measure of the taxes he should pay as compared with others whose taxes are based on the volume of their income.

After giving considerable thought to this question of taxation of agricultural lands, this Board herewith submits the proposed amendments to be made to the "Taxation Act," which will result (if they accomplish what they are intended to do) in taxing all farm holdings at the current rate on whatever value each may be assessed for up to a value of $25 per acre, which is equal to a tax at the present rate of 25 cents per acre on lands that reach that value, and when they get above that value, then whatever assessed value is made above that amount should be based on rental value.

This Board knows these recommendations constitute a wide departure from old methods of taxation, but the justice on which these recommendations are based is supported by the fact that there is no class in this Province which needs the encouragement that comes from fair treatment more than the farmers do, and that as compared with farmers in the Prairie Provinces their taxes are excessive.

PROPOSED AMENDMENTS TO "TAXATION ACT."

Amend section 52 of Act by striking out, and substituting the following:—

"Where the assessed value of any piece, lot, or subdivision of land, according to the assessment roll, is so small that the amount of tax imposed under the rate fixed by law will not subject such piece, lot, or subdivision to the payment of one dollar, then the said sum of one dollar shall be placed on the assessment roll as the tax against such piece, lot, or subdivision, and the Assessor shall value and assess each piece, lot, or subdivision separately, and shall enter the same on the assessment roll as a separate item."

Repeal section 86, and substitute the following:—

"The Lieutenant-Governor in Council may from time to time appoint three persons, who are residents of the assessment district for which they are appointed, to be a Court of Revision and Appeal in respect of the assessment of property and income as aforesaid for such district, and such persons shall record the proceedings of the said Court and deposit such records with the Assessor."

Amend section 91 by adding the following:—

"Provided, however, that where any owner of real property held and used for agricultural or horticultural purposes, of not less than twenty acres in area, and which is assessed at a value over twenty-five dollars per acre, makes an appeal against the assessment made by the Assessor, and makes a sworn statement as to its value based on its rental value, inclusive of buildings, the Court of Revision may fix the assessment at any value over twenty-five dollars per acre which is based on its rental value capitalized at ten per cent."

The Board submits also an amendment to the Act providing that increment tax be collected through the Registry Office on that portion of the price paid for land which appears above its assessed value.

Add a new section as 113A:—

"Where land or real property, or any portion thereof, is sold for a price in excess of a value equal to one-half of the sum of its assessed value for the two years next preceding such sale, there shall be payable upon the registration of the deed of transfer of such land a tax of five per centum on the increase of the value of said land over and above the value so determined, excluding in all cases the cost of improvement or development work done upon or in connection with such lands between the time of the last assessment and the time of sale."

In respect to the method suggested for arriving at the true basis for assessment of farm lands, it may appear that we have placed the percentage, at which rental value should be capitalized, too high, but in this Province, where leases are generally for short terms, the owner nearly always, and wisely too, undertakes to pay taxes and keep buildings insured, and beyond ordinary repairs he has to provide material for any important changes, and both material and work to build new or rebuild old buildings.

We would add, too, our reasons for not recommending the exemption of improvements on farm lands from taxation, which was recommended by both the Royal Commission on Taxation of 1911 and the Royal Commission on Agriculture of 1913. We think the proposal is based on a wrong principle, and its inconsistency will be easily seen, at least in respect to farm lands, if the rental value is considered.

For the purpose of production the improvements merge into that value and become inseparable from the land. Who can tell, from time to time, apart from the visible improvements, the cost of improving certain lands—clearing, dyking, draining, etc.—some of which disappear in the doing and some of which must be constantly repaired? Only the men who have borne the cost, a cost in some cases far beyond the price for which the land could be sold. And who can tell what a piece of land now improved would be worth in its natural state? There is no system of taxation can equalize the inequalities of good or ill in nature. It is only results, and not the energy and labour spent to produce them, that can be taxed.

The exemption of improvements from taxation, like some other expedients, has been suggested as a means of relieving a class from unequal and excessive taxation, brought about by a false system of estimating farm values, exaggerated in periods of speculation or gambling on future values, and which can only be corrected by taking rental value as a basis for taxation and taxing farmers in accordance with their "ability to pay" as compared with other taxpayers.

It is not our purpose to enter into any of those intricate questions of "payment for service rendered" or "benefit theory" of taxation with which economists deal, but it will be observed that we have recognized the right of the Government to levy on the landholder, without any regard to these principles, a basic tax or royalty on the land for the security of tenure given him as against any one else, and to pay for road-building and other public improvements to the extent of 25 cents per acre or whatever lesser sum the assessed value may indicate, together with whatever income-tax he may be found liable, to help to pay for general administration of Government.

In formulating the above suggested changes in respect to the taxation of farm lands, we have had in view, and had hoped to be able to submit in this respect, a recommendation to establish "road districts" in this Province similar to those which have been established in New Zealand and Australia, or to the "local improvement districts" established in Alberta and Saskatchewan outside of municipalities, but we regret to say that the time we have had to give to this matter has been too short for us to formulate a system which we could submit with confidence that it would prove suitable to the conditions in this Province. We think this can and should be done, in order that opportunity for and responsibility of increasing taxation on land may be put in the hands of the owners thereof, who may then fix the measure of the help they are able and willing to give to whatever amounts the Provincial Government may deem advisable to spend on such work out of general revenue, and which may in time reduce the amount of taxes levied by the Government on this class of property.

Small Holdings.

In respect to the assessment of lands held in areas of less than 20 acres, we are of the opinion that any lands divided into small holdings are put into a class different from that of farm lands. Where land is subdivided it is given somewhat of an urban character, and "site" value will enter into its assessable and sale value. Inasmuch as such subdivision makes more roads necessary, a heavier taxation is justifiable, and a rental value for agricultural purposes would be an unfair guide for such taxation. We must therefore recommend that such lands be assessed at their cash value, as is now provided for in the "Taxation Act."

We would add, further, that the subdivision of land into small areas should be discouraged, as we have evidence to lead us to believe that a great deal of harm has resulted from this being done in several parts of the Province. Indeed, British Columbia has prepared, in this respect, for an urban and suburban population that would accommodate half of the whole population of Canada.

The conditions that have been brought about in this Province through "high commercialism," where middlemen in cities, aided by cold-storage facilities, have been taking from the community, between the producers and consumers, from 10 to 100 per cent. on the price the producers get for their produce, led some individuals, encouraged by real-estate agents, to think that by filling the place both of producer and middleman they could from a few acres of land make not only a living, but a competence in a few years. It is known, however, that experience has taught many this is not so easy to be done; indeed, the disappointment of some who have tried is painful history.

Although there are no landlords here to prevent land from being subdivided, as under the metayer system, to a point where there would be no margin for rent between a living for a family and the produce of the holding, or to use similar means to that used by one of the great Scotch landlords who deported some of his crofters to Canada for fear that the subdivisions would get so small as to leave no margin for rent, it will be found that the middlemen's profits here will prove quite as great a check against close subdivision as the landlord's rent in Europe.

(2.) Taxation of Land for Mining Purposes.

We have no good grounds for thinking that the present principle, as set forth in Part V. of the "Taxation Act," for the taxation of land from which ore or mineral-bearing substances are taken should be changed; nor can we recommend at the present time any change in Part I. of the "Taxation Act" providing for the taxation of coal, and of lands from which coal is being mined, and of coal lands assessed under Class B; but we think that further time for inquiry might have led us to recommend that the income of persons and companies carrying on coal-mining should be brought under the income-tax part of the "Taxation Act," from which they are specifically exempt. To do this no doubt would necessitate some reduction of the tax on the coal produced from the mines as now provided.

(3.) Timber Lands.

In respect to the taxation of timber lands, we have some very strong evidence to show that the increase of the rate from 2 to 3 per cent. on the assessed value of Crown-granted timber land has resulted in placing the owners thereof under unequally heavy burden as compared with those holding licences for timber land, but we have not had the opportunity to investigate this and other matters connected with taxation of timber land closely enough to recommend any change in this branch of taxation.

(4.) Land held for Building Purposes.

This class of land consists mostly of land subdivided into small lots, and should be assessed on the same basis as lots in city municipalities—that is, at sale value.

(5.) Wild-land Tax.

We cannot recommend any change in the present taxation of wild land, though we do think it is one of the branches of land taxation that requires full investigation and consideration.

PERSONAL-PROPERTY TAX.

Personal property exists in many forms, as is shown by its definition in the "Taxation Act," but they may be divided into two classes:—

(1.) Machinery, implements, live stock, and other movable property, including liquid or circulating capital used in the production of fixed capital and goods for consumption:

(2.) Consumable goods in the hands of producers and of merchants for sale.

The inequality in the value of the personal property used in the different lines of production to produce equal values is too well known to need pointing out, and as it is the value of the things produced and not the value of the means used in their production that gives the "ability to pay," it is the former and not the latter should be the basis of taxation in order to make it equitable.

And it is equally well known that the movement of goods from the producers or manufacturers to the merchants and traders, and through them to the consumers, is so different as between one kind of goods and another that to tax the producer or manufacturer and the merchant or trader on the value of the goods the Assessor may happen to find in his possession at one period in each year is so manifestly unfair that to pursue it is an offence to all sense of justice, and points to the taxation of profits made by those engaged in the production and distribution of goods as the most equitable system of taxation.

From time to time changes have been made in the law to reduce the glaring inequalities of the burdens imposed under this branch of taxation, such as exemption of some of the implements and other means used in production, which reveal the untenable ground on which it is based, until it has now become "a thing of shreds and patches."

This Board has therefore to add its recommendations to those of the Royal Commissions on Taxation of 1905 and 1911, that this tax be abolished except in those cases where the use of certain kinds of personal property has to be regulated, and registration and licence fees are levied for that purpose.

INCOME-TAX.

Under the provisions of the "Taxation Act" which provide for the levy of a tax on income are included all those of the classes of persons above named who have incomes large enough to be taxed thereunder.

The definition of "income" in the "Taxation Act" is clear and exhaustive, but the following is quoted as a brief summary of what it is from another point of view:—

"Income is the returns which come into the individual as the result of his own economic activities or from the control of the economic activities of others."

For the purpose of taxation net income only is assessed; that is, the gross income less the amount expended in producing it, and the tax is levied without any consideration as to the amount of capital or other factor employed in getting or acquiring the income. It may come from profits on invested capital alone, or from the applied ability of the individual alone, or from both these or any other factor or factors combined.

Economists are almost unanimous in opinion that the imposition of a tax on income is the most equitable of all methods of taxation, because it takes from the individual or economic unit in a progressive ration a part of the amount he draws from the fund of wealth created by the community, without impairing the capital or any factor employed in the production of that wealth; whereas, in taxing improved lands producing food, or personal property or persons, there is a danger that the very sources of the production of wealth may be weakened or destroyed.

The great industrial and commercial development that has taken place in modern nations, generally carried on by bodies made corporate by law, which have drawn capital together under the joint-stock system aided and co-ordinated by banking institutions and supported, directly or indirectly, by other financial corporations, including life insurance and other similar companies, has called into existence new economic units which draw, first under their control and gradually into their possession, nearly all of the surplus earnings of the old economic units, and in consequence have weakened or destroyed the "ability" of the latter "to pay" the amount of revenue needed to meet the ever-increasing expenditure of modern Governments.

With the development that has given rise to these new and great economic units, and contributing largely to their growth, came an increase in international commerce that made it

impossible to readjust on the old forms of property, either real or personal, or by way of tax on licences or franchises, or to trust to a "diffusion" of the burden as between the economic units within the nation, such as could have been made and done if no such international commercial exchanges had taken place. These factors and resulting conditions have appeared in most countries; hence the need to find new sources of revenue has been forced on nearly every Government, and "income-tax has come to the forefront of public discussion with comparative rapidity."

Under the pressure of this need most Legislatures are declaring in favour of imposing a tax on incomes as well as a tax on inheritance, and in doing so have consciously or unconsciously declared once more the sovereignty of the community over the individual, a sovereignty that seemed to be eclipsed by the strong "individualism" which grew up during the last century in modern democratic nations; a declaration emphasizing the fact that the individual owes his personality to the community, and that the wealth he draws from it must be under the control of the State.

How far this "individualism" behind capital has led to the lack of unity in this country may not be within the scope of our work to discuss, but we venture to say we think it beyond question that it has not hesitated to use any means that it could control to make dividends on capital invested as large as possible, even to the extent of introducing labour of a race ethnologically so far apart from the parent race of the community as to cause immediate irritation, and, no doubt, disturbances in the future.

A lack of social and political morality in some of the classes whose incomes are large enough to make them liable for income tax has been pointed to as a reason that it should not be imposed, because the honest will pay and the dishonest will escape; but we wish to join with the Royal Commission on Taxation of 1911-12 in saying "we have too firm a faith in the integrity of our fellow-citizens to suppose that any such low standard of probity exists in this Province as would deter them from following out the natural evolution of fiscal policy." And we have no doubt but that with the aid of a careful Assessor each taxpayer will be able to estimate the amount of income he is drawing from the community.

We submit the following as changes which should be made to the "Taxation Act" in respect to exemption from and the rates of taxation on income as being more equitable than the present ones:—

INCOME-TAX EXEMPTIONS.

Proposed Amendment to Section 8, Subsection (18).—Strike out subsection (18) of section 8, and substitute the following:—

The income of single persons, including widows, widowers, or divorced persons without children, under seventy years of age	$ 800
The joint income of husband and wife living together without children under sixteen years of age	1,200
The joint income of husband and wife living together or either as a parent with children under sixteen years of age and $200 for each child under sixteen years of age.	1,200
The income of single persons over seventy years of age	1,000

NOTE 1.—The reason for the proposed change is obvious. No encouragement should be given to expensive living in a country so much in need of capital as this is, and those who can and will live luxuriously will not suffer by the change.

NOTE 2.—This Board thinks it is inconsistent with the principle on which a portion of the income of an individual is exempted—viz., a reasonable amount to live on—to allow any exemption to a body made corporate by law.

That the part of section 9 fixing the rates for taxation on income be struck out, and the following be substituted therefor:—

		Per Cent.
Class A.	On any sum not more than	$ 2,000.. 1
„ B.	On any sum not less than $ 2,000 and not more than	2,500.. 1¼
„ C.	„ „ 2,500 „	3,000.. 1½
„ D.	„ „ 3,000 „	3,500.. 1¾
„ E.	„ „ 3,500 „	4,000.. 2
„ F.	„ „ 4,000 „	5,000.. 2½

						Per Cent.
Class G.	On any sum not less than	$	5,000	and not more than	$ 6,000..	3
„ H.	„	„	6,000	„	7,000..	3½
„ I.	„	„	7,000	„	8,000..	4
„ J.	„	„	8,000	„	9,000..	4½
„ K.	„	„	9,000	„	10,000..	5
„ L.	„	„	10,000	„	12,500..	6¼
„ M.	„	„	12,500	„	15,000..	7½
„ N.	„	„	15,000	„	17,500..	8¾
„ O.	„	„	17,500	„	20,000..	10
On all sums over					20,000..	12

PROPOSED NEW FORM NO. 7.

Deductions allowed.

No. 1. Amount deducted, exempted under the Statute but only to natural persons, and not to include bodies made corporate by law.

No. 2. Outgoing or necessary expenses actually incurred and paid out in the production of the income by the taxpayer, other than expenditures on capital account or on reinvestment account.

No. 3. An allowance of a sum for anuual depreciation by ordinary wear and tear of the plant, machinery, equipment, and buildings, such sum to be based upon the probable annual average cost of repairs and renewals necessary to maintain the same in a condition of efficiency, and in no case to exceed for any year ten per centum per annum of the value at the commencement of such year, such value to be appraised by the Assessor.

No. 4. Losses and bad debts arising out of the business from which an income is derived, irrecoverable and actually written off during the year, but not otherwise.

No. 5. For municipal taxes and rates paid on real property from which an income is derived, but not otherwise.

No. 6. For all income derived from shares or dividends from companies or corporations (not being companies or corporations taxed under Part II. or under Part V. of the "Taxation Act") where such companies or corporations are assessed direct upon the real and personal property and income of such companies, but not otherwise.

No. 7. Money or capital received during the year as the price of any property sold, or any money paid back which was lent out on mortgage or other security, or payment of insurance due the taxpayer, or any capital paid to the taxpayer to which he is entitled from any investment whatever.

NOTES.—When the taxpayer keeps regular books showing his annual business, the figures given in the above returns must be correctly stated in accordance with such books, and such books shall be open to the inspection of the Assessor to enable him to verify the same. Stock-in-trade must be entered in the above return at the inventory value given in said books.

Deductions not allowed from gross income: (1) Any debts or liabilities paid out of income in any one year, where such debts or liabilities were not actually incurred in producing the income of that year; (2) any expenses or charges which ought, in the opinion of the Assessor, to be chargeable against the capital of the taxpayer and not against revenue; (3) any loss or expense not incurred by the taxpayer in the effort to produce the income; (4) the cost and maintenance of the taxpayer and his family, or establishment, or rent of house occupied by him; (5) domestic or private personal expenses; (6) taxes on real property, or on personal property, or on income, or any rate levy, tax, or assessment whatsoever, whether imposed or made or levied by or pursuant to any Act of the Parliament of Canada or of the Legislature of British Columbia, except the municipal taxes and rates allowed to be deducted under the said Form No. 7; (7) any loss or expense recoverable under any insurance policy or contract of indemnity, or not proved to the satisfaction of the Assessor, or which in the opinion of the Assessor ought not to be considered a loss, outgoing, or expense incurred by the taxpayer in the production of the income; (8) any income transferred from the gross income of the taxpayer to a sinking fund, contingent fund, reserve fund, or undivided profits; (9) income derived from any source outside this Province, if such income is brought into or used in this Province; (10)

any interest on borrowed capital from which an income is derived; (11) capital spent on improvements or betterments, or on account of interest which such capital would have brought if invested; (12) for any expenditure of a capital nature or for renewals or extensions; (13) for directors' fees, and for salaries of persons holding office as directors, and for the salary paid the president, vice-president, and general manager of any company or body corporate.

(*New.*) Provided, however, if a general manager is residing in this Province and is employed in the actual work of carrying on the business of the company, a deduction for his salary not exceeding $5,000 per year may be made. The following items to be filled up by the Assessor only:

1. The tax on personal property is ..... $.
2. The tax on income is ..... $.
3. The greater tax, or if 1 and 2 are equal, then the tax on income (2), as the case may be, is ..... $.

If the recommendation of this Board to discontinue "personal-property" tax be adopted, items 1 and 3 must be struck out.

The amount of No. 3 being the only tax payable by the taxpayer for personal property and income.

Reasons for Changes.

The reasons for recommending the changes to be made in Form 7 as submitted are as follows:—

This Board is of the opinion that it is inconsistent with the principle on which a portion of the income of an individual is exempted from taxation—viz., a reasonable allowance for cost of living—to allow any exemption for that purpose to a body made corporate by law.

The amendment made to No. 2, by striking out the words at the end thereof, "or to replace or provide against depreciation," is explained and provided for by No. 3 in form submitted.

The reason for recommending the striking-out of No. 3 of old form is that it must be assumed that capital invested in any undertaking is so invested with a fair certainty that sufficient profits will come from the investment to pay interest and any taxes imposed by the Government of the country in which it is made; and even if the principle were admitted, there being so much difference in the profits arising from the same amount of capital in different ventures even of a similar nature and investments of capital in ventures of a different nature, the amount of capital invested would be no guide by which to make exemption or deduction that would be fair to the owners of capital in the different ventures. Therefore this Board recommends that no interest be allowed to be deducted from profits before income-tax is levied thereon.

No. 3 of form submitted provides for allowance for depreciation, and is virtually a copy of the Ontario "Mining Tax Act."

No. 4 is a copy of No. 4 in Form 7 of present Schedule. The Board shows No. 5 of the present Form 7 eliminated for the reason that any one paying premium for life insurance is storing up capital in that way for future use or profit, and is the same in result as when a wage-earner stores up capital in buying a house by paying for it in instalments, or a farmer stores up capital in improving his farm. The Board is aware that this deduction is allowed in England, but, notwithstanding this, thinks it is wrong in principle.

No. 5 in the form submitted is a copy of No. 6 in Form 7 of the present Schedule, and No. 6 is No. 7 in the said form.

No. 7 in the form submitted is self-explanatory and only gives expression to a principle implied in the Statute.

Mining Taxation.

Re Allowing for Exhaustion of Mines.

This Board, after hearing the evidence submitted and the pleas made to support the proposal that such an allowance be made, cannot recommend that any such allowance should be made before income-tax is levied on net profits; for these reasons:—

There is no law we have found providing for such in any country whose laws we have inquired into where the taxation on mines is a tax levied on the net income therefrom, and in England the decisions of the Courts are clearly against it. It is safe to assume that before capitalists invest money in a mine they will know with a great degree of certainty the value of the ore-deposit therein, or, rather, they will have some proof that there is enough ore to

justify the venture, and will believe that in the operation of producing and selling the product of the mine they will be able to make enough profits to pay interest on the capital invested and create a sinking fund to replace the capital invested before the mine is exhausted.

They will be guided by the same principle by which a teamster is guided when he buys a horse, who expects to make enough profits from its use as will pay for feeding it and pay for another to take its place when it dies or is no longer able to do its work.

Re the Mineral-tax on the Value of the Ore, 2 per Cent.

The Board recommends the continuance of this tax, as it is levied in substitution for all taxes which *might* be levied upon the land from which the ore or mineral is taken, a tax on the estimated value of the ore in the ground, and for the personal property used in the working of such mines.

The great efforts that have been made to show that to levy this tax and to tax the profits made in the undertaking is dual taxation must fail under a proper analysis of their relation.

The mineral-tax is imposed on the party who is given possession of the mine, by licence or otherwise, and because he has been given control of it as against any one else in the community and secured by law in that control, and has no relation whatever to the principle or the basis of a tax on net income.

It is levied on the same principle on which a farmer is taxed for the privilege given him by the community for the exclusive use of his farm, and for the benefits that he receives from the community in the enjoyment of that use, and has no connection whatever with the tax levied on the profits he makes out of the community by the exercise of his energies applied to that farm. And the tax that is levied on farmers' profits is no greater in proportion than the tax levied on other taxpayers who have no privilege or licence to use any part of the domain of the country.

RE ALLOWING INTEREST ON CAPITAL INVESTED BY A COMPANY IN A VENTURE TO BE DEDUCTED FROM PROFITS BEFORE INCOME-TAX IS LEVIED THEREON.

This Board submits such should not be allowed. First, it is the amount of the net profits made by a company or individual which is the measure of the value of the opportunity given by the community to make such profits. This is the basis for and, indeed, proof of the fairness of a tax on net income.

And seeing that there is no fixed relation between the amount of capital invested and the amount of profit derived from the investment, it would work out unfairly to allow such deduction. It may happen—and, in fact, very often does happen—that a company investing half the amount of capital that another company invests will make as much profits from their venture as the other does.

In support of this recommendation, that interest should not be allowed on capital invested by a corporation, we quote the following from Professor Seligman. He says:—

"In England the income-tax payable on annual profits or gains, according to Schedule D of the income-tax, is advanced by the corporation, and is deducted by it from the dividends on interest due the security-holders, who are then to that extent exempt from the income-tax."

He says further: "Taxation of interest on corporate debt is not double taxation, because the coupons, like the dividends, are integral parts of the income; because both bonds and stock together form what is really the working capital from which the income is derived."

There is therefore the best authority for not allowing the deduction of interest on borrowed capital before income-tax is levied, and this principle will hold, with equal force, against allowing any rate of interest on invested capital being set aside before income-tax is levied on net profits.

PART II.

We recommend that persons taxed under Part II. of the "Taxation Act" be brought under the income provisions thereof, and that the Act be amended for that purpose.

RE COLLECTION OF TAXES.

This Board is of the opinion that the system of allowing a discount or rebate for the payment of taxes is wrong in principle and cannot be justified.

When taxes are levied it may be assumed that they are levied to raise a certain amount of revenue, and that the levy is made on the basis of "ability to pay" of each taxpayer, as evidenced by the assessed value of his property or power to pay, and to make that levy less on any class of the taxpayers for any reason whatever is doing a wrong to the other classes of the taxpayers, whose burden is increased in consequence.

That some may not be able to pay on the date taxes become due and payable is no reason that they should be made to pay more than their share of the required revenue. If justice is desired to be done, the amount of taxes levied against each taxpayer should be collected in full, and if any fail to pay at the date fixed for payment they may in fairness be asked to pay interest at a rate which it will cost the authority levying the taxes to borrow the money needed until the taxes falling in arrears are paid or collected.

To allow a fair bank discount on taxes paid on any date after the date at which they become due to the end of the period within which they may be paid would be fair, if practicable.

We regret that such an unjust system has found a place in the taxation laws of our Province, and express a hope that it will be abolished both in our Provincial and municipal systems, in the latter of which it has reached an inexcusable extreme. With this in view, so far as Provincial taxation is concerned, we submit proposed amendments to the "Taxation Act" in respect to the collection of taxes, as follows:—

(*a.*) Amend section 8, subsection (28), by striking out all the words after "municipality" in the second line thereof.

(*b.*) Repeal section 10, and substitute the following therefor:

"10. The aforesaid taxes shall be due and payable on the second day of January of the year for which said taxes are levied, and may be paid without interest at any time from such date up to and including the thirty-first day of March of said year, but if such taxes are not paid on or before the last-named date interest shall be charged thereon as provided in sections 211 and 212 of this Act."

(*c.*) Repeal section 112, and substitute the following:—

"112. In case there should be arrears of real-property tax, personal-property tax, or income-tax due by a taxpayer, and he should desire to pay off a portion of the said arrears before proceedings are taken for recovery thereof, the Collector may accept the amount tendered; but the amount so tendered shall in no case be less than one full year's taxes with interest thereon at the rate of six per centum per annum on all taxes so tendered in arrears for any year up to and including the year 1917, and with interest at the rate of eight per centum per annum for all taxes in arrears after that date to the date of payment; and the Collector shall apply the said amount to clear off the farthest back year or years in arrears (as the case may be) and grant a receipt therefor, and he shall state upon such receipt what amount is still due and owing by such taxpayer for real-property tax, personal-property tax, or income-tax."

(*d.*) Repeal section 148, and substitute the following:—

"148. The taxes imposed upon corporations, including banks, under this Part of this Act shall become due and payable on the second day of January of the year for which such taxes are levied, and may be paid without interest at any time from such date up to and including the thirty-first day of March of said year, but if such taxes are not paid on or before the last-named date they shall bear interest at the rate of one per centum per month from such last-named date until paid, provided payment of such taxes with interest aforesaid is made on or before the thirty-first day of December of such year; and if such taxes with interest as aforesaid are not paid on or before the said thirty-first day of December, the said taxes and interest thereon, which interest is hereby declared to be an addition to and a part of such taxes, shall be deemed to be delinquent on the said thirty-first day of December."

(*e.*) Repeal section 149, and substitute the following:—

"149. All taxes, including interest thereon, which became delinquent on the day last mentioned in the last preceding section shall thereupon bear interest at the rate of eight per centum per annum from such date until paid or recovered. Such added interest provided for in the last preceding section and in this section shall be deemed a charge upon the property of the person whose taxes are delinquent, in all respects as if said interest had originally formed part of the taxes assessed and levied thereon, and may be recovered as a part of the delinquent taxes."

(*f.*) Repeal section 211, and substitute the following therefor:—

"211. All taxes on real property, personal property, and income unpaid on the thirty-first day of March of the year in which such taxes become due shall bear interest at the rate of one per centum per month from the last-named date until paid, provided payment of such taxes and interest is made on or before the thirty-first day of December of such year; and if such taxes with interest as aforesaid are not paid on or before the said thirty-first day of December, the said taxes and interest, which interest is hereby declared to be an addition to and a part of such taxes, shall be deemed to be delinquent on the said thirty-first day of December."

(*g.*) Repeal section 212, and substitute the following therefor:—

212. All taxes, including interest thereon, which became delinquent on the day last mentioned in the last preceding section shall thereupon bear interest at the rate of eight per centum per annum from such date until paid or recovered. Such added interest provided for in the last preceding section and in this section shall be deemed a charge upon the property of the person whose taxes are delinquent, in all respects as if said interest had orginally formed part of the taxes assessed and levied thereon, and may be recovered as a part of the delinquent taxes."

ASSESSMENTS AND ASSESSMENT DISTRICTS.

Serious complaints have been made in regard to the inequality of assessments, which this Board believes to be well founded. In fact, the strongest complaints are because of the inequality of assessment rather than in regard to the rate levied on the valuation of real property. It is evident from the information given to this Board that assessments have not been carefully made under the present arrangement. This would appear to arise from the assessment districts being too large or from there being an insufficient staff to do the work.

In view of the unsatisfactory condition indicated, we recommend that under the provisions of sections 14 and 15 of the "Taxation Act" the work of a new assessment of the whole Province should be undertaken as soon as possible, and that the Province should be redivided into smaller assessment districts, so that it will be practicable for the Assessor to do the work in the district for which he is appointed in the manner contemplated by the "Taxation Act"; that is, to know the nature and condition of the property on which he places a valuation.

RE PERMANENT BOARD.

This Board, supported by the recommendation of Professor Haig, is of the opinion that a permanent Board of Taxation should be created on the lines indicated in his report, and that the Board should be cut clear as far as is possible from all political and special interests.

With the little time at its disposal to gather information, this Board submits it would be unwise for it, without further research, to attempt to draft a measure for the establishment of such a Board and to define its powers and duties in the directions pointed out by Professor Haig; therefore this Board recommends that advantage be taken of his offer to draft a constitution for such a Board. It is evident he is fully conversant with the work the Taxation Commissions in the several States in the Union have accomplished and what has been learned from their experience. In addition to this, he has intimate knowledge of the systems of taxation in the different Provinces of our Dominion, as shown by his able report thereon, prepared for the Committee on Taxation of New York, dated March 23rd, 1915, and we have evidence that since that time he has kept in close touch with taxation matters in the whole of Canada.

"SCHOOL ACT" AND SCHOOL TAXES.

This Board, under the instructions contained in section 9 of the "Board of Taxation Act," after hearing the evidence of several witnesses in respect to the present system of rural school taxation in this Province, as well as reading the evidence submitted to the Royal Commission on Taxation in 1911, and having had the privilege of being present at a meeting of the Executive Council which was held to discuss this question with Dr. Robinson, Superintendent of Education, has concluded that the inequality of taxation complained of arising under the present system can only be removed by changing the present system to one similar to that which was in force prior to 1906.

We think that the change made at that time to apply to school districts outside of municipalities was a retrograde one, unsuitable to this Province, and not in accord with the wish of a majority of its people. We think the people of this Province regard the children within its borders as their wards in respect to giving them at least a common-school education, and that the wealth or poverty of a parent should not be a measure of the opportunity his children should have in that respect. We therefore think that the ratepayers of one school district should not have to pay more, relatively, than those of another district, and in order to prevent this we recommend that the "School Act" be changed so that the whole of the taxable lands outside of municipalities, in proportion to their assessed value, should bear that portion of the cost of education which is now being levied on the several rural school districts.

Professor Haig's Report.

The Board transmits herewith the report received by it from Professor Haig. As already stated, this Board had reached conclusions on all the important matters relating to taxation and the sources from which Provincial revenues are drawn, as set forth in the foregoing report, before Professor Haig's report came to hand. In its perusal of the latter the members of the Board found a number of matters examined in detail with which it intended to deal, but which he has presented in a clearer manner, both in arrangement and expression, than it could hope to equal; and, indeed, he has covered a wider field, and with greater freedom of criticism, in the history of the finances of this Province than it, for obvious reasons, would have wished to do.

With the general tenor of his report, both in the preface and summary, this Board is in full accord, but there are some parts with which it does not agree, and therefore a short survey of his recommendations is necessary to show wherein the Board agrees and also where it does not agree, and the reasons for such difference of opinion.

His clear and full analysis of the amount and sources of revenue shows the changes that took place in these in the period of years his survey covers, and his review of the financial history of that period from 1905 to 1917 is one for serious thought. This, coming from one looking at it from an outside point of view, clear from any local or political bias, makes it all the more worthy of consideration.

Referring to the rapid rise in revenue from 1908 until it reached its highest point in 1912-13, and of its equally rapid decline to 1916-17, leads him to speak of the other part of the process in these words: "The spending proceeded with blissful confidence . . . Equipment and governmental services have been supplied with a lavishness that consumed the very unusual revenues of the prosperous years, and which has, in addition, strained the credit of the Province."

In view of the shrinkage of the revenue and the improbability of its expansion, he points to the situation as one that gives cause for great concern, if not alarm, and says: "Unless some unforeseen event should suddenly restore the demand for real estate, the people of British Columbia must face painful economy and burdensome taxation"; and "if the Province is not relieved of the menace of the Canadian Northern guarantee the situation will be very desperate."

This review leads him to point to and emphasize the need of the Government of this Province keeping expenditure in close balance with revenue raised from the ordinary sources, and not to rely on "land-sales" and other variable sources of revenue.

This Board is of the opinion that Professor Haig is entirely wrong in thinking that the war had anything to do in causing the shrinkage of revenue, and more especially in the cessation of land-sales; for these had practically stopped before August, 1914, and, in fact, there is every reason for believing that the war has had an opposite effect, in that it has helped to make many able to pay their taxes.

This Board is pleased that he anticipated it by his recommendation that a permanent Taxation Board be created with power to co-ordinate all the different branches of the work connected with assessments for and collections of taxes. We will refer more fully to this matter before concluding our report.

We will now deal with the matters on which we cannot agree with Professor Haig in addition to that already referred to—namely, the influence of the war upon the shrinkage of revenue.

It is our opinion that he has failed to grasp the situation in regard to the taxation of farm lands. If he had examined the assessment rolls of some of the assessment districts for the

years from 1905 to 1908, and compared the then assessed values with the assessed values of the same properties for the years from 1910 to 1914-15, and then with the values from the latter year to 1917, and tried to have discovered the causes for the rise in the values in the first period and the causes for their shrinkage in the latter period, we think he would have hesitated to say that 1 per cent. on farm land as now assessed is "not inordinately high," even in view of the "services rendered."

We believe there is no sound reason for this class of lands to be assessed higher in 1913-14 than they were in 1907-8, except where improvement made them more productive, and instead of values being lowered since 1914 they should be increased if the price of farm produce were taken as a basis for valuation. For this Assessors are not to blame, because under the provisions of the "Taxation Act" they cannot ignore the effect on prices of land that come from any wave of insanity of speculation to inflate land-values.

One per cent. might not be "inordinately high" if assessed values were on a sound basis, but there is hardly a district in British Columbia where inflation of values did not take place. If there is going to be any scientific system of taxation established in this Province, it cannot be based on this unsound and unscientific principle, for scientific taxation must mean equality of burden based on "ability to pay," and they who can readjust our taxation to reach that position or approach it most nearly are the best experts.

Professor Haig refers to the result of the imposition of the "wild-land" tax leading to "confiscation." This is a harsh word to use in this connection and hardly justifiable.

That it may lead to some having to sell land for less than they paid for it, or give up their venture, may be true, but the speculators who buy from the Government and lose are in no worse position than those who buy from private owners and lose. If they who buy from private parties fail to make good their payments, the property reverts to the original owners, and it is difficult to see why the same law should not apply to those who purchase public lands. Parties who have bought from the Government cannot say they have been wronged by the imposition of a new tax, for a "wild-land tax" has been a part of the taxation policy of this Province for a long time.

It is held by some that there is an implied contract on the part of the Government to make certain improvements out of the money received from these investors; but, if so, is there no implied responsibility on the part of these investors? Does not the imposition of a wild-land tax imply this? In so far as it is held to be a penalty for non-use of land it certainly does. Where men who have control of capital—the accumulated labour of the community and of which they are trustees from a community point of view—and invest that capital in land with the hope that the work and growth of the community will enhance its value to make such investment profitable, and the community fails to do so, it is a misfortune both to the investors and the community itself; for the value received on one side of the bargain—that is, by the investor—has not been realized, and is therefore a loss as compared with transactions where value received on both sides is made productive.

The whole situation is a matter for regret, and in the opinion of this Board is one that points to the need of making occupation and use part of the consideration to be given by those who are seeking to get control of any part of the public domain of this Province.

There is no need for us to make special reference, by way of comparison, to Professor Haig's opinion in regard to the taxation of mining and other companies and on income-tax, but will leave his opinions and our views to stand for your consideration.

In closing its report, this Board desires to express the belief that any diminution in revenue that may follow the abolition of the personal-property tax and the suggested changes in respect to farm lands will be more than compensated by a close assessment for and collection of the other taxes, as recommended, especially that of income-tax.

In a new country like this, where economic conditions should change more rapidly than in an old one, it gives ground for hope that the present sources of revenue will expand and that new ones will be created; but we fully recognize that all modern communities are bringing pressure to bear to force taxation to be derived from two main sources—taxation on land (i.e., on "land" in its widest meaning) and taxation on income.

And in regard to taxation on land, in so far as it is used for agricultural purposes, the tendency is to make the tax levied thereon bear some close relation to the "benefit received."

As we believe the latter can be done better by local bodies under proper Government control than by the Central Government, we have based some of our recommendations on that belief.

The great desire expressed on all sides for agricultural expansion, and the efforts being made by the Government of this Province to induce agricultural settlement, both point to the need of making taxation on farm land correspond as near as possible with the farmer's ability to pay. When most farmers are so much in need of capital as to have to borrow for purposes of developing their holdings, it is proof of the need of an endeavour to see that taxes on farm property be not excessive.

All of which, together with Professor Haig's report, communications, and transcript of evidence presented to this Board is respectfully submitted.

Dated at Victoria, B.C., the 5th day of April, 1918.

W. G. CAMERON,
THOMAS KIDD,
Board of Taxation.

INDIVIDUAL REPORT BY W. G. CAMERON.

MOTOR-VEHICLE TAX.

I recommend that the "Motor-traffic Regulation Act, 1911," section 14, be amended as follows:—

"The annual licence fee to be two per centum on the fair market value of all motors. Present annual licence fee and personal-property tax on motors to be cancelled."

AMUSEMENT-TAX.

I do not recommend any charge in regard to this tax, but think it should remain as at present.

TAXATION OF IMPROVEMENTS.

If the plan as outlined by this Board for assessment and taxation of farm lands is not adopted, I am in favour of the exemption of improvements from taxation, and recommend:—

(1.) That improvements be clearly defined in much the same way as in the "Municipal Act," section 2, with regard to district municipalities.

(2.) That land and improvements be assessed separately.

W. G. CAMERON.

INDIVIDUAL REPORT BY THOMAS KIDD.

TAXATION OF BANKS.

If that justice in taxation referred to herein is to be realized, there will have to be some change brought about in the attitude of the banks doing business in this Province.

It is an anomalous condition, which will not likely be much longer allowed to exist in Canada, that these institutions can refuse to give the information required to make each one bear its fair share of the burden of taxation imposed by the laws of this Province on income, an income which they draw from the community with exceptional powers and advantages granted them, and which would appear from known results far in excess of the value of the services they give the community.

The education of the public on matters of finance is advancing very rapidly, and the same intelligence and sense of justice that have pressed for and brought about the taxation of net income will not likely stop until these institutions are subjected to the same law as all other individuals and corporations.

MOTOR-VEHICLES TAX.

I recommend that the following fees be collected from the owners of motor-vehicles, to be in substitution for all taxes and rates that might be collected on the said vehicles under the present personal-property tax and the "Motor-traffic Regulation Act":—

One per centum on the purchase price of each vehicle in this Province when new, added to $10 fee per annum. Motor-cycles on same basis and $5 per annum, the registration fee to remain as now.

This will lessen the Assessor's work in assessing personal property and make the collection more simple by putting it in the hands of the Superintendent of Provincial Police. It probably will involve amending the provisions of the Act in respect to the assessment of personal property; this could be done by adding to section 64 of the "Taxation Act" the following:—

"Provided, however, that when any assessment is made of personal property it shall not include any motor-vehicle or motor-cycle."

AMUSEMENT-TAX.

I recommend the following Schedule to be substituted for the one in the present Act:—

	Cents.
Where the price of admission is not more than 5 cents	5
Where the price of admission is more than 5 cents and not more than 15 cents	10
Where the price of admission is more than 15 cents and not more than 25 cents	15
Where the price of admission is more than 25 cents and not more than 50 cents	20
Where the price of admission is more than 50 cents and not more than $1	25
Where the price of admission is more than $1 and not more than $2	30
Where the price of admission is more than $2	50

In recommending the increase of this tax to a scale that may seem excessive, I do so on the grounds that a tax of this kind may discourage the spending of money to excess on amusements that should not be indulged in overmuch when every one should be saving capital for more needful purposes. I would recommend further that whatever is collected from this source should go to support the different public hospitals in the Province, many of which are in great need of assistance.

On this subject I venture the following remarks on Professor Haig's reference to this tax, wherein he says: "It might possibly be justified as a war measure, designed to discourage a non-essential enterprise." And further on he says: "It is a tax that produces irritation out of proportion to its yield, and which distributes the burden with no defensible principle of taxation."

The last statement raises a point which I think is still under debate by economists; that is, whether "taxes levied on wealth in the using" can be defended on principle. It is certainly not more inequitable in distributing the burden than the tax on alcoholic liquors and tobacco, and, like the tax on these, by placing its collection on those who run the places of amusements it may be made to assume the character of an indirect tax.

This tax is not arbitrary, and as it is a tax on the consumption of a non-essential it may be looked upon as "voluntary"; indeed, the amount consumed may be taken as a measure as well as proof of "ability to pay." Like the tax on income, it may cause irritation; but as that will be largely confined to those in cities who can afford to pay for amusements of this kind, the irritation will not be serious.

I am therefore unable to see the reason for Professor Haig's opinion unless he bases it on the "subjective" aspect of the incidence of taxation, but I fear the majority of the people of British Columbia have not reached that stage of development which would enable them to appreciate the decisions of the psychological court that could determine whether the boy and girl whose opportunities to attend picture-shows have been cut in two suffer more or less mental anguish than the boy and girl who see a pet colt or a favourite brood of chickens sold by their father to pay his taxes.

But there is another aspect of this matter which Professor Haig may not have considered—namely, the effect of the thing consumed on the consumer. It has been suggested, with some strong circumstantial evidence to support it, that overindulgence in picture-shows by the pupils of public schools is distracting their minds from the more prosaic work of studying their lessons. If increasing the tax for admission to these places of amusement will have the result of lessening the attendance of that class its enforcement will be justified.

If one may judge from the great wave which has swept, with apparent success, both Canada and the United States recently in opposition to the sale of liquor under the licensing system, it is safe to conclude that there is something more than mere revenue being considered by the whole of the people in determining what shall be the principles of taxation and sources of revenue.

BOARD OF TAXATION.

In addition to the unanimous recommendation as above submitted in regard to the creation of a permanent Board of Taxation, I venture to submit the following, to which my colleague, Mr. Cameron, would not subscribe for the reason that in his opinion it was dealing with matters beyond the scope of the work assigned to this Board:—

In view of the recent proofs of lack of wisdom in the carrying-out of municipal government in this Province, I venture to suggest that the powers and duties of a Board of Taxation be extended to include the supervision of municipal borrowing and expending of borrowed money, on somewhat similar lines to that which the Local Government Board in Great Britain possess and exercise.

A prominent economist (Professor Bastable) says on this subject: "The necessity of some method of the kind is obvious; without it the numerical majority of the inhabitants of a district possessing little monetary interest in its future condition could burden all the holders of property and future residents with a load of debt." And he adds: "This power of regulation and its efficient exercise show the real unity of all public utilities."

The Royal Commission on Municipal Government had this matter under consideration, but seemed to think, as expressed in their report, that it was not advisable to establish such a system in this Province, but that "the Government should have full information as to what the municipalities are doing."

There is probably no country in the world where local bodies have had such unrestricted power as they have had in British Columbia, with results, in many cases, too well known to need to be recited, and which point to the need of steps being taken to prevent their recurrence.

THOMAS KIDD.

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SECOND REPORT

OF THE

BOARD OF TAXATION.

To Honourable John Hart,
Minister of Finance.

SIR,—We, the members of the Board of Taxation, beg to submit this as our second report, to which is attached a draft "Taxation Act." In the latter we have attempted to embody the provisions which we recommended in our first report to be made a part of the "Taxation Act," and have added others, all of which we believe are based on principles that will make taxation more equitable in this Province than it has been in the past; or, perhaps we should say, to change our system of taxation to correspond more nearly with changing economic conditions, in order that the burden of taxation may be more equitably distributed.

The taxation of land, which is the basic source of taxes, especially in a new country, is so important a part of our system that every effort should be made to adjust it fairly, and particularly in respect to farm lands. In this Province rental values, which should be taken as a basis for valuation of all classes of land, are not, even in our oldest settlements, very definitely fixed, but placing the responsibility for fixing the value of real estate on its owner, and providing that in case of sale a certain percentage of the amount he receives over the assessed value be taken as an unearned-increment tax, will have a tendency to get and keep real-estate values to a proper level and so prevent such violent fluctuations in prices as have taken place in the past.

In our former report we recommended an amendment be made to the "Taxation Act" to levy a tax on unearned increment as above indicated, but on further reflection we have not embodied that provision in the draft Act herewith submitted, having decided to recommend that the "Land Registry Act" be amended to carry out that purpose. We would suggest that such a tax be levied at a progressive rate, such rate to be the same percentage as the excess the vendor received over his equity in the property bears to that equity; such equity to be known as the "vendor's equity," and to be determined as follows:—

One-half of the sum of the assessed value of such property for the two years next preceding the date of sale plus 10 per cent. thereof, plus the value of any improvements made on or to the property between the time of the last assessment and the date of sale thereof: Provided, however, that no tax levied hereunder shall exceed 50 per cent. of the excess received by the vendor over his equity in the property.

In our former report we suggested that the rate placed on the increment be 5 per cent., but fuller consideration has led us to make the rate progressive, as above indicated.

In respect to the taxation of wild land and timber land from which timber has been cut and removed, or timber land whereon the timber has been destroyed by fire, we have made no change, but would recommend that the Assessor be careful in the valuation of such land, for if such lands have little value for agricultural purposes they should not be made to bear a tax above that value.

As indicated in our former report, we have made no provision for the taxation of personal property. In our investigations of taxation in other countries we find strong support for taking this course. In the United States, where the constitution of most of the States provides that real estate and personal property, usually known as "general property," shall be taxed at their full value and at the same rate, there is a strong effort being made in many States to have the tax on personal property abolished because, as we have pointed out, it imposes an unequal burden on the taxpayers, an inequality so extreme in many cases that it has led to all kinds of efforts being made to evade it, so much so that one writer has said that it had made nearly every man in his State a liar.

There is no part of our taxation system which works out so badly as this, and the provision in the present Act that gives the Government the alternative of taking the tax on the taxpayer's personal property or the tax on his income, whichever is the greater, only aggravates the injustice.

It may happen—in fact, we have evidence of such happenings—that persons doing business find at the end of the year their profit and loss account shows a loss, yet the tax on personal property calls for a large sum to be paid. This must be paid out of capital, a result that no system of taxation should bring about.

In the draft Act submitted herewith we have provided that the taxation of coal-mines be changed to bring the owners thereof under the income-tax provisions of the Act. We have done this for the reason, as we believe, that the present system is most unfair as between the owners of the different mines in that it takes, like the old tithe system, a fixed portion of the product without any consideration of the relative cost of producion as between one taxpayer and another. The measure of this injustice will be found by comparing the cost per ton of getting coal to the point of delivery for sale from the mine from which coal can be produced the cheapest, with the cost per ton of getting the coal to market from other mines whose output is produced under less favourable circumstances. The inequality in the incidence of taxation under the present Act no doubt discourages the working of mines that afford but a small margin of profit, and militates against the opening of new mines, which in the early days of development are unduly burdened by this method of taxation.

We have placed the value of coal lands, as such, for assessment at the price at which they can be bought from the Government—namely, $15 per acre. There is no practicable way by which an Assessor can determine the value of coal land as such, nor does the value of the surface give any index to that value. Therefore, to place these lands at an equal value for coal-mining purposes is probably as fair a way as can be followed for the assessment of such properties, the relative values of which can only be discovered by mining the coal. Although the relative value arising from difference of location might be considered as a reason for differentiation in assessed value, yet as this will be reflected in income and compensated for in the equalizing result of net income-tax, it need not be considered as important.

In providing for the taxation of mines other than coal-mines, we have followed the lines indicated in our former report; that is, to place in addition to a tax on the net income from the mine an initial tax on the net value of the ore in substitution for all the other taxes that might be levied—namely, a tax on the value of the surface of the land for the purpose for which it is used, a tax on the estimated value of the ore in the mine, and a tax on all the buildings, plant, and machinery used in or about the mine in connection with its operation. We have left out the alternative given to the Government by the present Act, to take a tax on the product of the mine or a tax on the income from it, whichever is found to be the greater. We submit that this method is wrong in principle and that it should not be followed, as it places an unequal burden on mine-owners in the comparative advantage to the mine with the richest ore and other favourable conditions as compared with other mines not equally favoured.

To put a fixed percentage tax on the net value of ore which costs 20 per cent. of its value to get it, and the same fixed percentage on the net value of ore that costs 80 per cent. of its value to get it, is so clearly inequitable that it has only to be stated to be condemned. Although the principle so condemned is applied in the draft Act submitted, its application to the extent provided finds justification in the fact that the tax so levied by it is in substitution for all the other taxes that might be levied, as above stated, as a real-property tax, and for the further reason that in the case of a struggling mine during the early stages of development it may be much less than those taxes would be for which it is substituted.

In the United States there is probably no subject of taxation which has aroused so much difference of opinion and controversy as the taxation of mines. This has arisen largely from the rigidity of the constitution of nearly all the different States, constitutions which crystallized into law the experience of a period when tangible property was taken as the sole evidence of the ability to pay taxes. The economic changes that have taken place since that time have created new conditions in which tangible property is not only incomplete evidence, but very misleading evidence as to where the "power to pay" is to be found. There is, therefore, in that country great effort being made to change this principle in taxation, and in many of the States some modifications have been made in that basic law. Yet few of them have got quite

free from that die-hard notion that all things having a sale value should be taxed on that value irrespective of their nature or use—not yet realizing that it is not the thing or means used in the production of wealth that should be taxed, but that it is the wealth produced that should be made bear the burden of taxation, as that is the only thing that gives the "power to pay."

Hence we find two impossible things attempted by Assessors there—one to value ore in the ground, the other to find out the amount of capital invested in some undertakings. The latter impossibility is stranger than the first, which arises from two causes—one of which is its amazing shrinkage if it is to be made the base of taxation, the other being its wonderful expansion if the interest thereon is allowed to be deducted before the income arising therefrom is charged with income-tax. The members of this Board have reason to think that no country in the world gives mine-owners a safer method of taxation than the one submitted herewith, for it practically imposes no taxes on them until their mines reach a productive stage.

The draft Act submitted provides for some changes in respect of the taxation of "certain corporations," all of which we believe to be in the direction of making the taxes on such more equitable, not only as between such bodies, but also in relation to other taxpayers. We cannot see how the present system, which provides for a tax on gross revenue of such dissimilar organizations as insurance companies and telegraph, telephone, and other public service corporations, can be reconciled on any common principle, the first drawing its revenue at a rate which by experience has been so fixed as to eliminate almost every chance of loss, and the second group using means of an ever-diminishing value and whose revenue must vary with the cost of material and labour. We have, therefore, for the above reasons, divided them in the Act on the lines indicated.

By bringing the fire insurance companies under its general provisions it will necessitate amending the "Fire Insurance Act," and so make all taxes that are not fees come through the taxing department of the Government. This Act will bring banks also under the income-tax provisions of the law. The provision in the present Act for taxing these institutions, which makes the levy upon them more in the nature of a licence than a tax, works out very unfairly as between bank and bank, and gives no certainty that they are paying less or more in proportion than other institutions which are deriving an income from the public. If more bank amalgamations take place, it will under the present system result in a shrinkage of the revenue from this source, and will likely render the inequality of the burden which now exists between bank and bank still more extreme. The revenue they would have to pay would likely be no more, as a whole, than they pay now. This may be assumed for the reason that the whole of the net profits of these institutions as shown by the latest statements is a profit of about $2.30 *per capita* for the whole population of Canada, which would give this Province about $1,000,000 as its share for taxation.

In regard to the taxation of railways, we have made no change in the provisions of the present Act. An examination of the data in the Canada Year Book showing earnings and expenses of the several systems in the Province—except that of the Canadian Pacific Railway Company, whose earnings in the Province are not separated from its total earnings—is not at all encouraging for an attempt to be made to get any revenue from a tax on their incomes. The Canadian Pacific Railway Company may be making considerable profit out of its operating in this Province, but we have no data to show how much. Even if that were known, any attempt to put an additional tax burden on that company, which holds a monopolistic position, might lead to increased rates being levied for their services that would be more loss than gain to the taxpayers of this Province.

In respect to the provisions recommended for the taxation of incomes, we wish to emphasize what we said in our former report in respect to deductions allowed and those that should not be allowed before income is charged with the tax. We submit that no deduction should be allowed for interest on borrowed money before the income is taxed, as it is contrary to the principle underlying the imposition of a tax on income.

Income-tax is a tax on the amount of wealth that the individual or economic unit draws out of the community, and the taxing power need not—should not—concern itself about the relative value of the means employed to get it, other than to allow that portion of such income needed to keep unimpaired the means used in the process of getting or earning it to remain free from taxation. Thus to the individual whose personal powers are his means for getting wealth there is enough of his income left untaxed to feed, clothe, house, and reproduce his kind; to

him and to all other units using additional means is allowed enough to make good the waste—diminishing value—of those additional means to be retained free of tax. But money has the unique quality or characteristic, unlike all other means that can be used, of not being subject to waste—not diminishing in value by its use; therefore nothing is needed to make good for waste by "wear and tear."

The above analysis shows that as to the wages paid to a man, or for the hire of a horse or a machine or for anything of diminishing value, which means are consumed in the using, there is the need of leaving that portion of the income of the economic unit employing them which is needed to reproduce them free from taxation, but that reason cannot be used to justify interest paid for the use of money, which is not consumed by its use, being allowed to escape taxation in the hands of the borrower before income-tax is levied on his income.

Until recently the English law did not provide for such allowance, but now it is allowed, provided the borrowing is for less than a year and from a bank doing business in the United Kingdom. The reason for the latter limitation is probably founded on expediency rather than justice. It is safe to infer that the decisions of the highest Courts in the Empire are what led up to the English law being amended. These decisions were based on the supposed fact that interest paid for the use of money in a business is similar in its effects in the economic process to money paid for the use of a machine, which, we submit, is not supported by a strict analysis of the fact. The fact that the law there provides for a higher rate of tax on unearned income points backward to support our conclusions, and a fuller analysis would show that to allow interest on borrowed money to be deducted from income before the tax is charged thereon is doing an injustice to the economic units which furnish their own capital.

As time goes on a closer analysis is being made of the relation of the economic units of a community to one another and to the community as a whole, which will lead to a more equitable distribution of the burden of the cost of government.

From the trend of thought as disclosed by leading writers on taxation, it must be inferred that net income is going to be made the measure of the ability of the economic unit to pay taxes, and before the application of this principle will vanish the claim for secrecy on the part of the individual as to the amount of the portion of the wealth created by the community he is drawing from them by his activities and power. The world is growing less and less inclined to look with patience on the claim of any one that this amount should be kept a secret from the other members of the community, a claim that his possessions are so sacred that no inquiry should be made to discover their value—an impatience that seems to grow in intensity in proportion with this growth; nor is the average citizen inclined to learn to appreciate the growth in the sensibility of the individual which, it is claimed by some, grows with his increasing wealth, and which makes him feel with increasing intensity the sacrifice he has to make in paying taxes in accordance with his power to pay them.

The intuitive recognition of the right of the community to take a portion of that which the individual has drawn from it, for the support of the Government, has found expression in many ways, and among the oldest of these is to put a tax on inheritance, which has been done by most nations. In the principle underlying the imposition of a tax on inheritance we find support and example for a tax on income. The tax on inheritance is a very crude and inequitable way to accomplish this purpose, but no doubt was applied in this way in the past because conditions were such as to make it very difficult to find out what the income of the individual was from year to year, but when death made it impossible for him longer to conceal the amount of his accumulations it was made easy for a tax of this kind to be levied.

The recognition of this social justice is now finding expression in most countries by the imposition of a yearly tax on incomes, and in following the example of the tax on inheritance is found justification for a tax at a progressive rate.

We do not recommend a higher rate to be levied on unearned income, because it leads up to a discrimination in respect of the means used to produce incomes, a discrimination that in many cases must be difficult to follow to a satisfactory conclusion, especially in a new country, and further because it is contrary to the true principle underlying the taxation of incomes.

Further, to levy a higher rate on the unearned income must lead up to a higher rate of interest being charged for the use of money in business, and thus give strength to the plea, otherwise unfounded, that interest on borrowed money should be deducted before income-tax is charged on profits.

The object this Board has had in view in drafting the Act submitted has been to provide that the revenue of the Province shall be drawn from two main sources—namely, a tax on land-values and a tax on income; and that the tax on the first shall correspond as closely as possible to the benefit such land receives from the work and presence of the community, including the owner, a benefit that should be measured by the increase in value given to such land as a means to produce wealth, the only true value land can possess. All other means used in the production of wealth we have intended to leave untaxed, leaving the tax on income to equalize the burdens of taxation among the taxpayers, which it will do if properly enforced.

In the draft Act submitted we have attempted to provide that all taxes levied on property values and income for the preceding year will become due and payable on May 1st of each year, that no rebate will be allowed on payment of any tax, and that interest will be charged on any tax not paid before the 1st day of July of the same year. This is in accordance with the recommendations set forth in our former report, and we think can be conformed to in practice. We have endeavoured to make simpler provisions in regard to the sale of land for taxes, and to make the tax-sale deed absolute and free from attack when it has been issued, after giving ample time for redemption and for attack of any defect in the tax-sale proceedings.

The members of this Board, after giving careful thought to the matter of submitting "a draft of proper provisions for the constitution of a permanent Board of Taxation," deem it inadvisable, with the limited knowledge they possess at present, to formulate such a constitution, but would submit as their opinion that if section 15 of the present "Taxation Act" be amended by striking out the word "Assessors" in the fourth line thereof, and substituting therefor the word "Taxation," it is all that is required in the circumstances; thus leaving with the Minister the power to determine from time to time, as occasion may require, the duties of such Board, which in the opinion of this Board should be advisory in respect of the Minister and supervisory in regard to the work of the Assessors and Collectors in the several districts of the Province.

All of which, together with the draft "Taxation Act" herein referred to, is respectfully submitted.

Dated at Victoria, B.C., the 11th day of February, 1919.

W. G. CAMERON,
THOMAS KIDD,
Board of Taxation.

DRAFT OF PROPOSED "TAXATION ACT."

An Act to assess, levy, and collect Taxes on Property and Income.

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of British Columbia, enacts as follows:—

Short Title.

1. This Act may be cited as the "Taxation Act."

Interpretation.

2. In this Act, unless the context otherwise requires:—

"Minister" means the Minister of Finance:

"Registrar of Titles," wherever used in this Act, shall include the Registrar-General and District Registrars of Titles; and registration, wherever herein in this Act required, is to be effected in the District Registry Office where the property is situated:

"Assessor" and "Collector" shall include Deputy Assessor or Deputy Collector for the district for which he is appointed:

"District" shall mean assessment district:

"Person" shall mean and include persons male and persons female, and also any and all companies, bodies corporate, corporations, firms, partnerships, general, special, and limited, syndicates, brokers, factors, associations, trustees, executors, administrators, guardians, agents, and receivers:

"Bank" shall include banking company, banking corporation, banking association, and savings-bank:

"Trustee" shall include executor, administrator, or guardian, committee, or receiver, the Official Administrator, and any person having or taking upon himself the possession, administration, or control of land or income affected by any express trust or having by law the possession, control, or management of the property or income of a person under any legal disability:

"Owner" means a person who holds a registered title of land in fee-simple or a tenancy for life, or being the holder of a registered agreement of purchase, and shall include the person through whom real property assessed and taxed is held liable for the payment of taxes levied against it:

"Taxpayer" means the person by whom or through whom taxes on real property or income or any other taxes levied by this Act are payable:

"Owner," in respect to a mine or mines, means the person owning, managing, leasing, or working the mine:

"Tax" and "taxes" shall extend to and include taxes on real property, wild land, coal land, timber land, income, and all other the several classes of property mentioned or referred to in and made liable to taxation by this Act:

"Land," "real property," and "real estate," respectively, means and shall include the land itself, and all buildings, structures, and permanent improvements or other permanent fixtures, machinery, or things erected upon or affixed to the land or to any building thereon, and all trees or underwood growing upon the land, land covered with water, and all quarries and substances, other than mines and minerals as hereinafter defined, in and under the land:

"Wild land" means all land, other than coal land and timber land, claimed by any person on whom there shall not be existing improvements to the value, when assessed, of two dollars and fifty cents per acre, in addition to the cash value of the land itself, on land situate west of the Cascade Mountains, and of one dollar and twenty-five cents per acre on land situated east of said Cascade Mountains; but improvements upon any part of the land owned or claimed by any person shall be deemed to be improvements upon the

immediately adjoining land of such person to the extent of one hundred and sixty acres on land situate west of the said Cascade Mountains, and of three hundred and twenty acres on land situate east of the said Cascade Mountains, in like manner as if such improvements had been equally distributed over the whole one hundred and sixty acres or three hundred and twenty acres respectively, except where the land of such person adjoining such improved lands are suitable only for pastoral purposes, and where the business of farming and stock-raising is jointly operated by him, in which case the value of the improvements shall apply towards exempting from the wild-land tax such adjoining pastoral lands: Provided, however, that where wild lands are situate within a radius of five miles from the boundary of an incorporated town or city which has a population of not less than five thousand persons, the quantity of wild land to be exempted from the wild-land tax shall be limited to forty acres to the assessed owner or occupier thereof. Lands subdivided as townsites into lots of two acres or less in extent, regularly surveyed and shown upon a plan thereof, duly registered, shall not be assessed as wild land:

"Coal land" means all land owned, leased, held under licence, claimed, or occupied by any person for the special purpose of mining coal therefrom, and which is not held or used for any other purpose:

"Timber land" means any holding of the land which in the opinion of the Minister of Lands is held in sufficient areas for the purpose of forestry within the provisions of the "Forest Act," which is owned or occupied under any Crown grant of the Province or is held under lease or licence from the Crown within the purview of the "Forest Act" by any person for the specific purpose of cutting or removing timber therefrom, or as an investment for the accruing value of the timber thereon, and for no other purpose, which contains milling or merchantable timber to the average extent of eight thousand feet to the acre west of the Cascade range of mountains and of five thousand feet to the acre east of said range to each one hundred and sixty acres, and which has been classified as timber land for taxation purposes under the provisions of this Act by the Assessor after he has received from the owner or occupier thereof the return and certificate of the Minister of Lands provided for in section — of this Act; and also all timber land held under lease or licence from the Crown not requiring classification for taxation purposes under this Act, but which the Minister of Lands considers to be timber land within the provisions of the "Forest Act." Timber land from which timber has been cut or removed shall be classed as wild land, unless and until improved as provided for herein in the definition of "wild land": Provided, however, that where land is being cleared of timber and underbrush for the purpose of making it fit for agricultural, pastoral, or commercial purposes by a bona-fide settler it shall not be classified as timber land:

"Mine" means and shall include any land in which any vein or lode, ore-body, or rock in place shall be mined for gold or other minerals, precious or base, except coal, and any natural stratum or bed of earth, gravel, or cement mined for gold or precious minerals, or stones, including all placer mines, creek, bar, dry, bench, hill, and precious-stone diggings from which gold and other precious minerals or precious stones or base minerals are dug, dredged, mined, or won:

"Mineral" or "mineral-bearing substance" means and shall include all valuable deposits of gold, silver, platinum, iridium, or any of the platinum group of metals, mercury, lead, copper, iron, tin, zinc, nickel, aluminium, antimony, arsenic, barium, bismuth, boron, bromine, cadmium, chromium, cobalt, iodine, magnesium, manganese, molybdenum, phosphorus, plumbago, potassium, sodium, strontium, sulphur (or any combination of the aforementioned elements), asbestos, emery, mica, and all mineral pigments:

"Ton" shall mean two thousand pounds avoirdupois, except in respect of coal:

"Cattle" shall include polled and horned cattle, horses, and mules:

"Income" means and shall include the amount earned, derived, accrued, or received from any source whatsoever, the product of capital, labour, industry, or skill, during the twelve months ending the thirty-first day of December immediately preceding the date of assessment, or during any portion of the said period, and shall include, without being specially defined or enumerated, all wages, salaries, emoluments, and annuities accrued or due for any purpose whatsoever, and all income, revenue, rent, or interest accrued

or due from bonds, notes, stock, shares of stock, debentures (including interest or dividends from the stock, bonds, or debentures of the Dominion of Canada, and of this Province, and of any municipality of this Province), and from real and personal property, and from interest on money lent, deposited, or invested, and from all indebtedness secured by deed, mortgage, contract, agreement, or account, and from all ventures, businesses, professions, offices, avocations, or employments of any kind whatsoever; and means and shall include all the rents, incomes, and profits of every business and every corporate undertaking, and every industrial, manufacturing, and business undertaking of every nature and kind whatsoever, however arising, received, gained, or acquired, subject nevertheless to the exemptions hereinafter in this Act defined: Provided that where any person has a method of accounting fixing a fiscal or business year ending on any other day than the thirty-first day of December, the Minister may, in his discretion, adopt such other day as the day from which to compute the income of such person for the preceding twelve months.

Division of Act.

3. This Act is divided into three parts, relating to the following subjects:—

PART.

I.—General Taxation of Property and Income:

II.—Taxation of Railways and Railway Subsidy Lands:

III.—Miscellaneous Matters.

PART I.

GENERAL TAXATION OF PROPERTY AND INCOME.

4. All real property and income within the Province shall be liable to taxation, and every person shall be assessed and taxed on his real property and income in accordance with the provisions of this Act, subject to the exemptions and provisions hereinafter mentioned and contained.

5. Lands in respect of which no Crown grant has issued, but which are held from the Crown by pre-emption or lease, or under agreement by the Crown to sell, grant, or convey, or are simply occupied, shall be liable (while so held or occupied or during the existence of such agreement) to taxation from the date of pre-emption record, lease, or agreement to sell, grant, or convey, or date of occupation (as the case may be), and the person holding a pre-emption record, lease or agreement of purchase from the Crown or otherwise in occupation of such land shall be held liable to pay taxes assessed and levied on such land and improvements thereon, but such taxation shall not in any way affect the rights of His Majesty in such lands.

6. The following persons and property shall be assessed and taxed specifically pursuant to the several parts of this Act governing the subject:—

(*a.*) Certain corporations:

(*b.*) Persons canning and curing salmon or other fish and by-products thereof, and persons manufacturing whale-oil or other by-products of whales or other sea animals:

(*c.*) Mines and minerals other than coal and coke:

(*d.*) Mining property held by Crown grant and not worked:

(*e.*) Railways and railway subsidy lands.

Exemptions.

7. The following property shall be exempt from assessment and taxation, that is to say:—

(1.) All property now vested, or hereafter to be vested, or held in trust for His Majesty, or now held, or hereafter to be held, as Dominion railway lands, and all lands to be conveyed to the Dominion Government under the eleventh section of the "Terms of Union," or otherwise, or held by His Majesty, or vested in any public body or body corporate, officer or person, in trust for His Majesty or for the public uses of the

Province; and also all property vested in or held by His Majesty, or any other person or body corporate, in trust or for the use of any tribe or body of Indians, and either unoccupied or occupied by some person in an official capacity:

(2.) When any property mentioned in the last preceding subsection is occupied by any person otherwise than in an official capacity, the occupant shall be assessed in respect thereof, but the property itself shall not be liable:

(3.) All lands used exclusively for public burying-grounds or cemeteries, not exceeding five acres, and the personal property and income derived from public burying-grounds and cemeteries, when such personal property and income are used wholly for burial purposes, but not otherwise:

(4.) Every public library, society, mechanics' institute, and other public literary, or scientific institution, and every public mining institute or society, with the land owned by and attached thereto, not exceeding one acre, and the personal property and income thereof, when such land, personal property, and income are used wholly and exclusively for the purposes and benefit of such public institutions, but not otherwise:

(5.) Every agricultural or horticultural society, with the land owned and attached thereto, not exceeding twenty acres, and the personal property and income thereof, when such land, personal property, and income are used wholly and exclusively for the purposes of horticulture and agriculture:

(6.) Every public university, normal school, manual-training school, school-house, Court-house, gaol, industrial school, industrial farm, lunatic asylum, house of correction, house of reformation, orphanage, orphan asylum, asylum for the blind, asylum for the deaf and dumb, institution for the reformation of fallen women, homes for the aged and infirm, public hospitals for the care of the sick, and isolation hospitals, when such institutions are supported in whole or in part by public donations, private charity, or by grants from the Province, and the land, personal property, and income of such institutions when such land, personal property, and income are used and devoted, after paying the necessary expenses thereof, wholly and exclusively to the benefit and purposes of such institutions, but not otherwise:

(7.) The property, real and personal, and income of fire companies used and applied for the prevention and extinguishment of fires when so used and applied, but not otherwise:

(8.) The personal property and income of the Governor-General of the Dominion, and the personal property and income of the Lieutenant-Governor of the Province:

(9.) The full or half pay of any one in His Majesty's Regular Army and Navy in actual service; any pension, salary, gratuity, or stipend derived by any person from His Majesty's Imperial Treasury, and all the personal property and income of any person in such Military or Naval services on full pay, or otherwise in actual service:

(10.) All pensions payable out of the public moneys of His Majesty's Imperial Treasury, or out of the public moneys of the Dominion, or of any Province thereof:

(11.) All property, real and personal, which is situate without the Province:

(12.) Land within the limits of any municipality:

(13.) Every public road, way, highway, and public square or park used exclusively for public purposes, but not otherwise:

(14.) So much of the income of persons as is provided for in this Act:

(15.) Homesteads under the Dominion "Land Act" and pre-emptions under the Provincial "Land Act" for two years from the date of entry or record and to the extent of five hundred dollars of the value thereof for a period of four years thereafter: Provided, however, that if a Crown grant is issued sooner than the expiration of such periods this exemption shall cease:

(16.) Timber and coal lands held under lease or licence from the Crown, in virtue of the "Land Act" or "Coal and Petroleum Act" of this Province, under which a royalty and rental is reserved, or under which a licence fee is reserved for the use of His Majesty, while so held, but not otherwise:

(17.) All property, real and personal, of a city or district municipality:

(18.) The ordinary income of local benevolent societies raised by means of dues and assessments from its members:

Division of the Province into Assessment Districts.

8. For the purposes of this Act, the Lieutenant-Governor in Council shall have power to divide the Province into assessment and collecting districts and to define the boundaries thereof, and from time to time to alter the boundaries of any district and create new districts.

Assessors and Collectors—Appointments and Duties.

9. It shall be lawful for the Lieutenant-Governor in Council from time to time to appoint such person as he shall think proper as Surveyor of Taxes and Inspector of Revenue, and in like manner to appoint a person as Deputy Surveyor of Taxes and Inspector of Revenue; also to create a Board of Assessors for the purpose of consulting and deciding upon the best methods to obtain correct and equitable assessments throughout the Province, and for any other business connected with the discharge of their duties; and to appoint Assessors and Deputy Assessors, Collectors and Deputy Collectors for the districts created; also to prescribe regulations for governing them respectively in the performance of their respective duties.

10. Every Assessor and Collector, before entering on the duties of his office, shall enter into a bond for the faithful performance of his duties.

11. Such bonds shall be given by the said Assessor or Collector in such sum and such manner as the Lieutenant-Governor in Council shall require in that behalf.

12. The Collector shall pay over monthly to the Deputy Minister of Finance all moneys received by him, and the Collector shall prepare and forward, on or before the first day of February of each year, to the Surveyor of Taxes and Inspector of Revenue a detailed statement of all arrears of taxes due at the thirty-first day of December immediately preceding the said first day of February, showing the land upon which arrears are due, the names of the persons assessed therefor, the amounts in arrear for income, and the names of the persons assessed therefor; and in each statement he shall show, in separate columns, the arrears due for each year.

13. The Assessor shall, on or before the fifteenth day of May in each year, prepare and forward to the Surveyor of Taxes and Inspector of Revenue a certified copy of his assessment rolls as finally revised at the Court of Revision.

14. The Assessors and Collectors shall obey all departmental rules and regulations which may from time to time be issued under this Act.

15. If an Assessor neglects or omits to perform his duties, the other Assessor, or other Assessors (if there be more than one for the same district), or any Assessor or Assessors appointed temporarily for the purpose, shall, until a new appointment, perform the duties, and certify upon his or their assessment roll the name of the delinquent Assessor, and also, if he or they know it, the cause of the delinquency.

16. If any Assessor or Collector, acting under this Act, makes any unjust or fraudulent assessment or collection, or wilfully and fraudulently inserts the name of any person who should not be entered, or fraudulently omits the name of any person who should be entered, or wilfully omits any duty required of him by this Act, he shall, upon summary conviction before any Stipendiary or Police Magistrate, be liable to a fine not exceeding five hundred dollars, and imprisonment until the fine be paid, or to imprisonment for a period not exceeding six months, or to both such fine and imprisonment, in the discretion of the Court.

17. If any Assessor or Collector wilfully omits to perform any duty required of him by this Act, and no other penalty is hereby imposed for the omission, he shall be liable to a penalty of five hundred dollars, to be recovered from him in any Court of competent jurisdiction at the suit of the Minister.

18. (1.) Every person liable to be assessed and taxed under the provisions of this Act shall make a return or returns to the Assessor as provided in the several parts of this Act. In each such return the person shall state an address to which all notices and other documents to be mailed or served under this Act may be mailed or sent. Printed forms for the purpose of this section shall be supplied by the Assessor to any person on request.

(2.) If a person liable to taxation hereunder is unable for any reason to make the return required by this section, such return shall be made by the guardian, committee, curator, tutor, or other legal representative of such person, or if there is no such legal representative, by some one acting as agent for such person, and in the case of the estate of any deceased person, by

the executor, administrator, or heir of such deceased person, and if there is no person to make a return under the provisions of this subsection, then by such person as may be required by the Minister to make such return.

(3.) The Lieutenant-Governor in Council may from time to time alter, amend, or vary the said form, and may demand such other information from the taxpayer as to the nature and value of the property and income liable to assessment, and the taxpayer shall supply the information required by the said form and demand. The Assessor shall not be bound to accept as correct any of the returns so made to him, but shall, in any case if he thinks it necessary or expedient, or if he suspects that any person who has not made a return is liable to taxation, make independent investigation as to the property and income of the taxpayer or person, and he shall make his own valuation and assessment of the taxable amount. If the Assessor requires further details and more explicit particulars and returns from any person or taxpayer, he may demand the same by notice in writing stating his requirements in general terms, and every person or taxpayer receiving such a notice shall be bound to comply with the terms thereof fully and completely and within fourteen days after receipt by him of such notice. The Assessor may personally or through an officer appointed by the Minister examine the books and accounts, and any documents or vouchers relating thereto, of the person or taxpayer.

(4.) The Minister may at any time enlarge the time for making any return.

(5.) No person employed in the public service of the Province shall communicate or allow to be communicated to any person not legally entitled thereto any information obtained under the provisions of this Act, except such information as is required by law to be shown on the assessment rolls, or allow any person not legally entitled thereto to inspect or have access to any written statement furnished under the provisions of this Act. Any person violating the provisions of this subsection shall be liable, on summary conviction, to a fine not exceeding two hundred dollars.

19. The returns shall be made and signed by the taxpayer or his accredited agent, and in the case of a corporation, association, or partnership, by the president, secretary, treasurer, member, or chief agent having a personal knowledge of the affairs of such corporation, association, or partnership; or, in any case, by such other person employed in the business liable or believed to be liable to taxation as the Minister may require. The Assessor may in any case require the correctness of such return to be verified by the statutory declaration of the person who signs the same.

20. It shall be the duty of every person assessable for property or income in any assessment district to give all necessary information to the Assessor in respect thereof.

21. The Deputy Minister of Lands and the Commissioner of Lands in each land district shall, on or before the first days of January, April, July, and October in each and every year, transmit, or cause to be transmitted, to the Assessor of each assessment district a correct list of all land within his assessment district which may have been recorded, pre-empted, leased, granted, or sold, or agreed to be leased or sold by the Crown, including Crown grants issued for mineral or placer claims, or leases thereof, which may have been issued during the last preceding three months. They shall also in addition thereto, on or before the first day of January in each year, furnish the Assessor with a complete list of all pre-emptions abandoned within his assessment district during the year previous thereto.

22. All Commissioners and other officers, clerks, and sub-agents of the Department of Lands throughout the Province, the Registrar-General, the District Registrars of Titles, Government Agents, Mining Recorders, Gold Commissioners, and other officers or agents of the Government of this Province shall, on the written request of the Assessor, furnish him, without any charge therefor, with such information as he may consider necessary for compiling and completing his assessment roll.

23. Every Registrar of Titles shall, on or before the first days of January, April, July, and October in each and every year, transmit to the Assessor in each assessment district a correct list of all transfers of land during the previous three months within the Assessor's assessment district, giving the date of transfer, the description of the land, the owner's name and address, and the value upon which the registration fees of the transfer is based.

24. In the event of any returns required under this Act to be made by the taxpayer containing any wilfully false or deceptive statement, or fraudulently omitting to give a full, true, and complete statement of the property and income of the taxpayer, the taxpayer making such

wilfully false or deceptive statement, or fraudulently omitting to give a full, true, and complete statement of his property and of his income, shall, in addition to the penalties hereinafter provided, pay to the Assessor the ascertained adjusted amount of the tax for the period covered by the said return, with one hundred per cent. added thereto, which added percentage shall be deemed a portion of the tax for the said period; and all the provisions of this Act shall, as far as applicable, apply to the said added percentage.

25. In every case where the taxpayer knowingly and wilfully makes any false or deceptive statement in any of the returns required by the Assessor under this Act, such person shall, on complaint of the Assessor, and upon conviction before any Stipendiary or Police Magistrate or Justice of the Peace, be liable to forfeit and pay a fine of not less than one hundred dollars and not more than five hundred dollars, or to imprisonment for a term not exceeding six months, or to both fine and imprisonment.

26. Every person who, without reasonable excuse, fails, refuses, or neglects to comply with any of the requirements of this Act in respect of returns or lists to be made under this Act, or who withholds any information necessary for ascertaining the true taxable amount of any mine, mineral, property, or income, shall, on summary conviction, be liable to a penalty not exceeding five hundred dollars for every such offence.

27. In every case in which any person makes default in furnishing any return required under this Act, or if the Assessor is not satisfied with the return furnished by the taxpayer, the Assessor may make an assessment in such sum as in the Assessor's judgment ought to have been charged under this Act, and the Assessor shall have power, at any time after the yearly closing of his assessment roll, to make a supplementary assessment roll, and to add to the assessed value of the property and income of any person in any year any property or income that may have been omitted from returns made to him, or that may have come to his knowledge as having been omitted from any return, or may not have been assessed; and thereupon the Assessor shall give notice thereof to the person assessed, and such person shall pay the tax upon the same, subject, however, to the taxpayer's right of appeal to the special Court of Revision and Appeal provided for in this Act.

ASSESSMENT OF REAL PROPERTY, COAL LANDS, AND TIMBER LANDS.

Returns to be made to the Assessor.

28. Every person being the owner of real property, including wild land, shall, for the purpose of aiding the Assessor to fully and correctly ascertain the value of such property, make, on or before the first day of September of each year, a return to the Assessor of the assessment district wherein such property is situated, on forms to be supplied by the Assessor on request by such owner, and such return shall contain a full, true, and correct statement of the value of the land or real property owned by him within the said assessment district at the date of such return.

29. Where the owner, lessee, or licensee of any coal land is mining coal therefrom and is using any part of the surface of such land in connection with the operation of such mines and the transportation of coal therefrom or for any other purpose, he shall furnish the Assessor with a return giving the value of all buildings, structures, improvements, fixtures, and machinery, and all other things attached to the land necessarily and actually used for the purpose of operating such coal-mine and coke-ovens (if any) thereon, or for any other purpose, and in such return he shall give the full value of the surface of such land for the purpose for which it is used: Provided, however, that railways used exclusively for the carriage of coal from the mines or material and workmen to and from the mines, if such carriage is free of charge, shall not be taxed.

30. Every owner, lessee, or licensee of coal lands from which coal is being mined shall, between the first day of July and the first day of September of each year, furnish the Assessor a return showing the number of tons of coal mined and taken from such land during the twelve months ending the thirtieth day of June preceding the date of such return, and in such return he shall designate and describe by the legal or other well-defined description an area consisting of a number of acres of such coal land, or coal land adjoining such coal land, equal to one-fifth of the number of tons of coal so mined and gotten from such land. The area so designated and described shall be classed as Class A coal land. All other coal land shall be classed as Class B coal land.

31. (1.) In addition to the return referred to in subsection (4) of this section which has to be made to the Assessor on or before the first day of June in each year, every owner of timber land shall furnish to the Assessor a certificate from the Minister of Lands, to be obtained on application by the owner from the Minister of Lands, showing that the regulations of the Department of Lands under the "Forest Act" concerning the prevention of fire and the scaling and marking of timber cut from said land have been complied with, and showing also that payment has been made to the Land Department of all charges authorized that year on that behalf, and that all royalties, taxes, and charges imposed under Parts VII. and XI. of the "Forest Act" have been duly paid by the owner to the Land Department.

(2.) Notwithstanding anything to the contrary in this Act, the assessed value of timber land for taxation purposes shall include in one item upon the roll the value of the growing timber thereon, as well as the value of the soil or land, and upon which values the tax shall be levied.

(3.) Where the growing timber upon timber land has been accidentally destroyed by fire and is usually known as "burned-over land," the land shall be assessed as "wild land," unless and until improved, as provided herein in the interpretation of "wild land," to take it out of that class.

(4.) Every owner of timber land shall furnish to the Assessor, on or before the first day of June in each year, a return of his timber land, giving in detail the legal or other well-defined description of each parcel, the acreage thereof, the average number of feet of merchantable timber to the acre thereof, and the cash value per acre of each parcel, together with a plan showing the exact acreage, locality, and description of the portion of such land from which timber has been cut or removed, and the value of the land from which the timber has been so cut and removed; and in the event of such return not being furnished the Assessor may assess the whole of such timber land as wild land.

Preparation of Assessment Roll.

32. The Assessor of each assessment district shall, between the first day of September and the thirtieth day of November of each year, prepare an annual assessment roll for the assessment and taxation of land and real property within his district, into which, after careful examination of the returns made to him by the owners thereof as hereinbefore provided, and from such other information as he may deem reliable, he shall set down the following particulars: The name and last-known address of every person having taxable property within the district, and shall set down opposite the name of each such person a description of the property assessable to such person and the class to which it belongs, whether "real property," "wild land," "coal land, Class A," or "coal land, Class B," or "timber land," and the assessed value of each such property and the amount of taxes levied against such property; and any other information that may be considered necessary by the Minister. Where any alterations of the completed roll are made at the Court of Revision and Appeal, such alterations shall be shown in red ink, and such roll, as revised at such Court of Revision and Appeal, shall be the completed roll for the recovery of the taxes shown thereon.

33. Any error, omission, or invalidity made or arising in the preparation of the assessment roll, or in any notice of assessment, may be corrected by the Assessor at any time before the sitting of the Court of Revision; and it shall be the duty of every person receiving a notice of assessment to advise the Assessor of any error, omission, or invalidity he may have observed in the assessment of his property, in order that the Assessor may correct the same. It shall also be the duty of every person, when requested by the Assessor, to furnish him with a correct legal description, for the purpose of assessment, of each parcel of land owned or occupied by him in the Assessor's assessment district.

34. Where any land has for the first time become liable to taxation by reason of its having been recorded, pre-empted, leased, or sold, or agreed to be leased or sold by the Crown, or by any railway company, between the first day of October and the thirty-first day of December in any year, the Assessor shall add such land upon a supplementary roll and assess the same for the year immediately following the said thirty-first day of December.

35. All the duties imposed upon the Assessor with respect to his assessment roll, and all the provisions of this Act relating to the assessment roll, shall, where applicable, apply to the separate or supplementary rolls.

36. (1.) Real property shall be assessed at its actual cash value in money. In determining the actual cash value of real property in money, the Assessor shall not adopt a lower or different standard of value because the same is to serve as a basis of taxation, nor shall he adopt as a criterion of value the price for which the said property would sell at auction, or at a forced sale, or in the aggregate, with all the property in the assessment district, but he shall value the property by itself, and at such sum or price as he believes the same to be fairly worth in money at the time of assessment. The true cash value of property shall be that value at which the property would generally be taken in payment of a just debt from a solvent debtor.

(2.) Where real property is held and used for agricultural, horticultural, or pastoral purposes, and is by the return made to the Assessor by the owner thereof shown to be of less value than is indicated by the average amount of income for the three years immediately preceding the date of such return, then the Assessor may increase the assessed value of such property to a value based on such income capitalized at eight per cent., or to a higher value if the Assessor has reason to believe the property has a higher value for the purpose for which it is used.

(3.) Where real property is being used for business or industrial purposes, and the land apart from the improvements thereon has a special value arising from its location or other natural advantages, making it favourable for the purpose for which it is being used, the rental value of which cannot be clearly separated from the rental value of the whole real and personal property employed in the business or industry, and the return made by the owner to the Assessor does not in the opinion of the Assessor place the true value on such real property, the Assessor may revalue the same, and shall take into consideration the location or value of such land in determining the value of the real property for the purpose for which it is used, and shall add thereto the full value of the improvements thereon at the time the assessment is made to make up the full assessed value of such real property. Where land is being used in connection with residence premises for pleasure-grounds or park purposes and the return of the owner to the Assessor does not in the opinion of the Assessor show the true value thereof, the Assessor shall assess such real property at its full value, based on the full value of the land and the full value of the improvements thereon at the time the assessment is made, to make up the full assessed value of such real property.

37. All coal land shall be assessed, as such, at the rate of fifteen dollars per acre: Provided always that where the surface of any land within an area owned or held as coal land is used for any purpose, named and set forth in section 29 of this Act, it shall be treated as real property, and shall be assessed and taxed as such in addition to the tax imposed on the land as coal land.

38. All real property lying or being within an assessment district shall be assessed and taxed in the assessment district in which the same is situated, subject to the exemptions in this Act.

39. Land and real property shall be assessed to the owner thereof: Provided, however, that when a person is assessed as trustee, agent, guardian, receiver, executor, or administrator, he shall be assessed as such, with the addition to his name of his representative character, and such assessment shall be carried out in a separate line from his individual assessment, and he shall be assessed for the value of the real and personal estate held by him, whether in his individual name, or in conjunction with others in such representative character, at the full value thereof, determined as in the last preceding section.

40. (1.) Where any real property is registered in the name of any person as the owner of an undivided interest in a parcel, the said owner shall be assessed for the undivided interest in such parcel belonging to him in the proportion which such undivided interest bears to the assessed value of the whole of said parcel. No separate assessment and no entry upon the assessment roll shall be made against undivided interests in a parcel of land where the undivided interests are in less proportion than one-eighth of the whole, and in the event of the undivided interests being in less proportions than one-eighth of the whole, the parcel of land shall be assessed in the names of the last registered owners of undivided interests in proportions of not less than one-eighth, and the taxes due thereon shall be payable by them, saving their right to recover from owners of undivided interests in less proportions than one-eighth.

(2.) Where the title to any land has become vested in His Majesty in right of the Province, subject to any estate or interest therein of any person, or where the title to any lands is vested in His Majesty and it appears that any person had, prior to the vesting of such title in His Majesty, acquired or had such a right, whether legal or equitable, to an interest in such lands as would be enforceable against a private individual if such title were vested in a private

individual, and that such person has such right though he may not have actually acquired such interest, it shall be lawful for the Assessor to assess the interest of such person or the right of such person to an interest in such lands by estimating the value of the whole of said lands at their cash value per acre, and the proportion thereof representing the value of the interest or of the right to an interest of such person shall be set down by the Assessor upon his roll.

(3.) No appeal shall lie to any Court whatsoever from the assessment by the Assessor of the interest or the right to an interest in such lands, except on one or both of the following grounds:—

(*a.*) That the assessment is excessive; or

(*b.*) That the person assessed has no interest in the lands assessed or in any part thereof.

(4.) The appellant shall, before his appeal is or can be heard, file with the Court or the Registrar of the Court appealed to an affidavit setting forth the interest which the appellant claims in the lands involved in the appeal.

(5.) If there be no appeal or if the appellant's appeal be dismissed, the assessment as made by the Assessor shall be binding on the person assessed and upon every person claiming by, through, or under him.

(6.) No Crown grant shall issue in respect of any such interest unless and until all the taxes appearing on the assessment roll as chargeable against such interest have been paid.

41. Land within any assessment district and lying outside the boundaries of any municipality which is divided into villa or suburban lots, or other subdivisions, shall, if a plan thereof is duly registered in the Land Registry Office or District Land Registry Office, be assessed and taxed to the individual owner of each subdivision or lot, and if a plan thereof be not so registered, the whole of the said lots or subdivisions shall be assessed and taxed as so many lots to the last registered owner of the land before it was so subdivided. The owner of the land so subdivided according to the registered plan thereof shall furnish the Assessor, when requested by him so to do, with a list of all lots sold by him, giving the name of the purchaser, the date of the purchase, and the price paid, or agreed to be paid, for the same, and the Assessor shall thereupon assess to each individual owner the lots so purchased, or agreed to be purchased, and the balance remaining unsold to the owner of such unsold portion of the said subdivision.

42. Where the assessed value of any piece, lot, or subdivision of land according to the assessment roll is so small that the amount of tax imposed under the rate fixed by law will not subject such piece, lot, or subdivision to the payment of a tax as high as one dollar, then the sum of one dollar shall be placed on the assessment roll as the tax against such piece, lot, or subdivision, and the Assessor shall value and assess each such piece, lot, or subdivision separately, and shall enter the same on the assessment roll as a separate item.

43. When any owner of a townsite or other subdivision of land assessed within any assessment district files and registers a plan thereof in the Land Registry Office, he shall immediately thereafter furnish to the Assessor of the assessment district in which the land is situate a copy, tracing, or blue-print thereof, for the information and guidance of the Assessor.

44. The provisions of this Act as regards the tax on real estate shall not apply to, nor shall taxes on real estate be assessed, levied, or collected on, real estate which is situated within the boundaries of any municipality.

Mode of assessing Incomes.

45. All income derived from real and personal property in the Province, and all income derived from any other source whatsoever or wheresoever brought into, received, earned, or got by any person, body corporate, trustee, agent, receiver, guardian, executor, or administrator in the Province, shall be assessed and taxed subject to the exemptions in this Act, and not otherwise specially assessed and taxed under this Act.

46. Every person having income in the Province, other than railway companies assessed and taxed under Part II. of this Act, shall, without any notice or demand, and on or before the first day of February of each year, make a return to the Assessor of the district, wherein such income is liable to be assessed and taxed, on the Form No. — of this Act, and such return shall contain a full, true, and correct statement of the income of the person making such return for the calendar year ending the thirty-first day of December preceding the said first day of February.

47. Every person receiving income from more than one assessment district shall make a return showing the full amount of his taxable income from all sources, and shall state therein the assessment district in this Province in which he elects to be assessed and taxed on such income, and shall forward, on or before the first day of February of each year, such return to the Assessor of the district so elected by him: Provided, however, that the certain corporations assessed under sections 53, 54, and 55 hereof for income shall make their returns to the Assessor of the Victoria Assessment District. Any person making a return required by this section shall not thereby be relieved from making the return required to be made to the Assessor of each district from which a part of the whole amount of the income of such person is received.

48. Every person when making a return of his income to the Assessor of the district in which the income is acquired shall furnish the Assessor with a correct list of those employees of the said person, each of whose income is at a rate that will exceed for the year the exemption for the class in which each such employee is placed by the provisions of this Act, and in the said list he shall state the amount paid by him to each employee within and for the year ending the thirty-first day of December preceding the date of such return.

49. The Assessors shall, from the returns so made or from such other information as they may be able to obtain, fix and determine the assessable and taxable income of every person in the Province.

Preparation of Assessment Roll for Income.

50. The Assessor of each assessment district shall, between the first day of February and the first day of April in each year, prepare an annual assessment roll for the assessment and taxation of income, into which, after careful examination of the returns made by those having income within the district and after careful inquiry from such sources as he may deem reliable, he shall set down the following particulars: The name and last-known address of every person having taxable income within the district, and set down opposite the name of each such person:—

(1.) The gross amount of income of such person for the calendar year preceding the date of assessment:

(2.) The amount of exemption allowed therefrom:

(3.) The net amount and class of such income:

(4.) The rate thereon:

(5.) The amount of the tax charged:

(6.) Any other information that may be required by the Minister.

51. For the purpose of ascertaining the amount of taxable income of every person, the Assessor shall allow as deductions from the income of such person the deductions specified in the Form No. — in the Schedule to this Act as they shall respectively apply to such person: Provided, however, that the deduction to be made under item 1 shall be determined as follows:—

(*a.*) From income of single persons, including widows, widowers, or divorced persons under seventy years of age without dependent children or other dependents incapable of self-support, eight hundred dollars:

(*b.*) From the joint income of husband and wife living together, or either, as a parent, with children under sixteen years of age, twelve hundred dollars; and an additional amount for each child under sixteen years of age and for each dependent incapable of self-support, two hundred dollars:

(*c.*) From the income of a single person over seventy years of age, one thousand dollars:

(*d.*) Where any person is using land for agricultural, horticultural, or pastoral purposes and his gross income derived from the use of such land is not less than two thousand five hundred dollars, the amount of the above-specified deductions, except under subsection (*c*) hereof, shall be reduced by forty per cent. thereof; and where the gross income of such person from such land is not less than one thousand five hundred dollars, the amount of the above-specified deduction, except under subsection (*c*) hereof, shall be reduced twenty per cent. thereof:

(*e.*) Where a person employs labour in the production of his income and finds board for his employees, he may add to the wages paid to such employees a sum equal to one-third of the amount so paid for wages, provided such one-third does not exceed one dollar per day for each such employee, and enter such increased amount as wages paid in the production of his income:

(*f.*) Where the reduced deductions as specified in subsection (*d*) of this section are made from the gross income of any person described therein, the reductions so made shall be in substitution for the value of all the food consumed by such person which he has produced on such land, or exchanged for other articles of food consumed by him.

52. No other deductions from the income, in order to arrive at the taxable income, shall be allowed to any person or taxpayer than those set forth in the said Form No. 7, and none of such deductions shall include any of the following items:—

(1.) Any debts or liabilities paid out of income in any one year, where such debts or liabilities were not actually incurred in producing the income of that year:

(2.) Any expenses or charges which ought, in the opinion of the Assessor, to be chargeable against the capital of the taxpayer and not against revenue:

(3.) Any loss or expense not incurred by the taxpayer in the effort to produce the income:

(4.) The cost and maintenance of the taxpayer and his family or establishment, or rent of house occupied by him:

(5.) Domestic or private personal expenses:

(6.) Taxes on real property, or on personal property, or on income, or any rate, levy, tax, or assessment whatsoever, whether imposed or made or levied by or pursuant to any Act of the Parliament of Canada or of the Legislature of British Columbia, except the municipal taxes and rates allowed to be deducted under the said Form No. —:

(7.) Any loss or expense recoverable under any insurance policy or contract of indemnity, or not proved to the satisfaction of the Assessor, or which in the opinion of the Assessor ought not to be considered a loss, outgoing, or expense incurred by the taxpayer in the production of the income:

(8.) Any income transferred from the gross income of the taxpayer to a sinking fund, contingent fund, reserve fund, or undivided profits:

(9.) Income derived from any source without the Province, if such income is brought into or used within the Province:

(10.) Any interest on borrowed capital from which an income is derived:

(11.) Capital spent on improvements or betterments, or on account of interest which such capital would have brought if invested:

(12.) For any expenditure of a capital nature:

(13.) For directors' fees, and for salaries of partners and of persons holding offices as directors, and for the salary paid the president, vice-president, and general manager of any company or body corporate: Provided, however, if a general manager is residing in this Province and is actually employed in carrying on the business of the company, a deduction for his salary not exceeding five thousand dollars per year may be made:

(14.) Any allowance for depreciation, except such amount for depreciation of vehicles, machinery, plant, and buildings used in the production of the income as may be allowed at the discretion of the Minister, not to exceed for any one year fifteen per centum of the actual and original cost of such vehicles, machinery, plant, or buildings.

Taxation of Certain Corporations.

53. All returns to be made by corporations named in sections 54 and 55 hereof shall be for the whole business carried on by them within the Province, including all their branches and agencies throughout the Province.

54. The following corporations, namely: Every telegraph company, every telephone company, every express company, every gas company, every waterworks company, every electric lighting company, every electric power company, every street-railway company, every trust company, every loan company, and every bank, shall, in addition to making a return in respect of any real property each such company may own to the Assessor of the district in which such real property is situated as required by this Act, make, without any notice or demand, a return to the Assessor of the Victoria Assessment District, on or before the first day of February in each year, showing the amount of revenue or income received by such company from all sources within the Province for the year ending the thirty-first day of December preceding the said first day of February, and such returns shall be accompanied by a certified copy of its "balance-sheet" and "profit and loss account" for the said year; and every corporation named in this section shall be assessed and taxed on its income from all sources under the same classification

and at the same rates as are other persons assessed and taxed on income under the provisions of this Act.

55. The following corporations, namely: Every life insurance company, corporation, and association, every insurance company other than a life insurance company, and every guarantee company transacting business in the Province, shall, in addition to making a return of any real property each such corporation may own to the Assessor of the district in which such real property is situated as required by this Act, make, without any notice or demand, a return to the Assessor of the Victoria Assessment District, on or before the first day of February of each year, showing the amount of revenue received for premiums for insurance and guarantees by each company within the year ending the thirty-first day of December preceding the said first day of February; also a return showing the amount of revenue received from all sources other than that from premiums above mentioned for the year ending the thirty-first day of December preceding the said first day of February, and such returns shall be accompanied by a certified copy of the "balance-sheet" and "profit and loss account" of such corporation in respect of the income derived from all sources, except premiums aforesaid, within the Province by such company for the said year; and every corporation assessed and taxed under this section shall be assessed and taxed on its income from all sources, other than that received for premiums as aforesaid, at the same rates and under the same classification as are other persons assessed and taxed on income under this Act, and shall be taxed on all revenue from premiums at the rate of two per cent.

Taxation of Canneries and Whaleries.

56. Every person carrying on the business of canning, curing, dry-salting, or preserving in ice salmon and other fish, in addition to making a return in respect of his real property to the Assessor of the district in which such real property is situate, shall, not later than the first day of February of each year, furnish to the Assessor of the Victoria Assessment District, on a form to be supplied by the Assessor, a return showing the number of pounds of salmon and other fish canned, cured, dry-salted, and preserved in ice, respectively, by such person during the year ending the thirty-first day of December immediately preceding the date of such return.

57. Every person carrying on the business of manufacturing oil from fish, whales, and other sea animals, in addition to making a return in respect of his real property to the Assessor of the district in which such real property is situate, shall, not later than the first day of February in each year, furnish to the Assessor of the Victoria Assessment District, on a form to be supplied by the Assessor, a return showing the number of gallons of fish-oil and whale-oil and the number of pounds of fertilizer, whalebone, bone-meal, and other products and by-products, respectively, manufactured and produced by such person during the year ending the thirty-first day of December preceding the date of such return.

58. All returns required to be made by the persons described in the foregoing sections 56 and 57 shall be for and include the whole business carried on by each such person in the Province, including all branches and agencies thereof, during the year, and each such person shall accompany each such return with a full, true, and correct statement of the income derived from all the business carried on during the year by such person, together with a certified copy of his "balance-sheet" and "profit and loss account" for the year ending the thirty-first day of December preceding the date of such return.

59. Under the heading of "Certain Corporations," such being named and defined in sections 54 and 55 of this Act, and under the heading of "Canneries, Fish-curing Establishments, and Whaleries," the Assessor of Victoria Assessment District, between the first day of February and the first day of April in each year, shall, for the purpose of assessing and taxing such corporations and persons defined in sections 56 and 57 of this Act for the calendar year preceding the said first day of February, prepare assessment rolls, in which he shall, from the information contained in the returns furnished by such corporations and persons, and from such other information as he may obtain from any other source, set down:—

(*a.*) The name and address of each such corporation:

(*b.*) The gross amount of income received during the year by such corporation for premiums and guarantees, less the amounts paid for reinsurance (if any) on business done within the Province during the year by such corporation:

(*c.*) The gross amount of income received during the year by such corporation from all sources other than premiums as aforesaid:

(*d.*) The name and address of every person above defined in sections 56 and 57 of this Act:

(*e.*) The number of pounds of fish of all kinds canned, cured, dry-salted, and preserved in ice by such person during the year:

(*f.*) The number of gallons of fish-oil and whale-oil produced and manufactured by such person during the year:

(*g.*) The number of pounds of fertilizer, whalebone, bone-meal, and other products and by-products manufactured from fish, whales, and other sea animals during the year.

TAXATION OF MINES AND MINERALS OTHER THAN COAL AND COKE.

Mode and Rate of Taxation.

60. Mines and minerals shall, for the purposes of taxation, be regarded as a separate class of property, and the assessment and taxation thereof shall be regulated by the provisions of this Act relating thereto.

61. It shall be the duty of the owner or manager of every mine, whether the same be a mineral claim, placer claim, mining leasehold, or other mining property from which ore, minerals, or mineral-bearing substances are being raised, gotten, gained, extracted, or produced, forthwith to notify the Assessor of the district of the fact that any such mine mentioned above is in active production, and from time to time to furnish the name and address of the manager or person to whom notices hereunder may be addressed, and thereafter all notices required hereby may be given by letter directed to such address; and the Assessor shall forthwith, from information received therefrom or from other sources, prepare a list or roll showing all producing mines in his district.

62. It shall be unlawful for any person to ship, send, take, or carry away, or permit so to be shipped, sent, taken, or carried away, from the mining premises wherefrom the same may have been raised, gotten, or gained, any ore, minerals, or mineral-bearing substances raised, gotten, or gained until the last preceding section has been complied with.

63. Every owner of a mine, other than a coal-mine, shall be assessed and taxed on his income as provided for in this Act for the taxation of incomes, and shall, in addition to the return or returns to be made by him for that purpose, make, on or before the first day of February in each year, to the Assessor of the district in which such mine is situated a return showing:—

(1.) The amount of ore, minerals, or mineral-bearing substances shipped or sent from or treated on the mining premises during the calendar year preceding the date of such return:

(2.) The amount of ore, minerals, or mineral-bearing substances shipped or sent from the mine during the calendar year preceding the date of such return:

(3.) The name of the smelter or mill and locality to which the same are sent:

(4.) The cost per ton for transportation to smelter or mill:

(5.) The cost per ton for smelter or mill charges:

(6.) The amount of ore, minerals, or mineral-bearing substances treated on the mining premises during the calendar year preceding the date of such returns:

(7.) The value of the ore shipped, exclusive of the charges for freight or treatment and cost of mining:

(8.) The value of the ore treated on the mining premises, exclusive of the charges for treatment and cost of mining.

64. The assessable value of ore and mineral-bearing substances, for the purposes of this Act, shall be the gross value thereof after deducting from such gross value the cost of transporting the said ore and mineral substances to the smelter or mill, and the cost of treating the same at such smelter or mill or on the mining premises, together with the cost of mining the same.

65. Every owner of an iron-mine shall, on or before the first day of February in each year, make to the Assessor of the district in which such mine is situated a return showing:—

(1.) The amount in tons of iron ore produced from such mine during the calendar year immediately preceding the date of such return:

(2.) The market value of such ore at the mine.

66. At any time after making an assessment, or accepting taxes, based upon a return or returns furnished pursuant to section 64 hereof, should the Assessor ascertain that the said

return is, or the said returns are, misleading, incorrect, or did not furnish sufficient information upon which to arrive at the correct amount at which the output of the mine in question should have been assessed for the period covered by said return or returns, the Assessor may, from such information as he may be able to obtain, notify the manager, or other person to whom notices may be addressed, of the additional amount payable in respect of the output of the mine for the said period, and require payment thereof, and such notice shall state the date of a special meeting of the Court of Revision and Appeal to be held not less than fourteen days after the date of said notice.

Appeal.

67. Any person who is dissatisfied with the amount claimed by the Assessor, acting under the last preceding section, may appeal to the Court of Revision and Appeal against the said assessment, and he shall be entitled to have the objection heard by such Court. The Court of Revision and Appeal shall have power to sit from time to time specially to hear and determine such appeals. The notice of appeal shall state the grounds of the objections in detail, and must be given by the person making the same within ten days from the date of the Assessor's notice.

Powers of Assessor to enter Premises.

68. (1.) For the purpose of determining the quantity and value of ore, minerals, or mineral-bearing substances for which any person is assessable, and either before the receipt of a return or after such receipt, it shall be lawful for the Assessor to enter upon any mining premises from time to time for the purpose of ascertaining the quantity of ore, minerals, or mineral-bearing substances raised, gotten, or gained from the said premises; and for this purpose the Assessor may descend all pits and shafts and use all tackle, machinery, appliances, and things belonging to the mine as he shall deem necessary or expedient, and he shall have free ingress and egress to, out, and over all buildings, erections, and vessels used in connection with the workings; and he shall from time to time be allowed to take from the said mining premises such samples or specimens as he may desire for the purpose of determining, by assay or otherwise, the value of the ore, minerals, or mineral-bearing substances being raised, gotten, or gained therefrom.

(2.) Every person liable to pay the tax imposed hereby shall keep upon the mining premises proper books of account of the ore, minerals, or mineral-bearing substances raised, gotten, or gained from the said mining premises, containing all particulars of weight and value, showing the smelter or reduction-work or other returns, or the amounts derived from the sale of such ore, minerals, or mineral-bearing substances, and other facts and circumstances necessary or proper for ascertaining the amount of the tax payable hereunder.

(3.) And no ore, minerals, or mineral-bearing substances raised, gotten, or gained out of any mining premises shall be removed therefrom until the weight and value thereof shall have been correctly ascertained and entered in the said books of account, to which books of account and to the returns above mentioned the Assessor shall have full and complete access for the purpose of examining the same, and taking copies thereof or extracts therefrom.

Penalties.

69. Any owner or manager of a mine making any wilfully false or deceptive statement in the return required by sections 63 and 65 of this Act shall be liable, on summary proceedings before a Stipendiary or Police Magistrate, or two Justices of the Peace, to a fine of one thousand dollars, and, in default of payment thereof, to imprisonment for a term not exceeding six months.

70. In the event of any return mentioned in the last preceding section containing any wilfully false or deceptive statement, the owner of the said mine, in addition to the penalty provided by the said section, shall pay to the Assessor the ascertained adjusted amount of the tax for the period covered by the said return, with one hundred per cent. thereof added thereto, which said added percentage shall be deemed a portion of the tax for the said period; and all the provisions of this Act with regard to the said tax shall, as far as applicable, apply to the said added percentage.

71. Any person failing to transmit the returns as provided in sections 63 and 65 of this Act or to furnish the information required by the Assessor shall be liable to the penalties imposed by sections 69 and 70 of this Act.

72. Every owner of a mine, other than a coal-mine, being the owner or lessee of the surface rights of the mineral claim or claims in which such mine is situate, and who is using or leasing for use for any other purpose than for buildings, structures, fixtures, and machinery and all improvements and things attached to the land necessarily and actually used for the purpose of operating such mine, shall, on or before the first day of September in each year, make a return to the Assessor of the district showing the value of the surface of such mineral claim or claims and the improvements thereon for the purpose for which the same are used, and the Assessor shall assess and tax such lands and improvements as real property.

73. The Assessor of every district in which a mine or mines other than coal is being worked shall prepare a separate roll, under the heading of "Assessment Roll," for the assessment and taxation of mines and minerals other than coal, and shall, on or before the first day of April of each year, from the returns made to him as herein provided, and from such other information as he may obtain from any other reliable source, set down:—

(1.) The name of each mine and name and address of the owner thereof:

(2.) The amount of ore or mineral-bearing substances extracted from such mine during the calendar year immediately preceding the date of assessment:

(3.) The gross value of such ore as shown by the smelter returns:

(4.) The net value of the ore shown after deducting cost of extracting or mining the ore from the ground, the cost of transportation of the ore to the mill or smelter, and the cost of smelting or treatment of same:

(5.) The amount in tons of iron ore produced from each iron-mine during the calendar year immediately preceding the date of assessment:

(6.) The market value of such ore at the mine:

(7.) And any other information the Minister may require.

74. There shall be levied and collected a tax of one per cent. on the net value of all ore as shown on the assessment roll for each year, except on iron ore, and there shall be levied and collected a tax of thirty-seven and one-half cents on each ton of iron ore as shown on the assessment roll for each year, and such taxes shall be due and payable on the first day of May in each year.

75. The tax levied by the last preceding section shall be in lieu of and in substitution for all taxes that might be levied under the provisions of this Act on the real property, buildings, machinery, and fixtures used in the operation of the mine, and for any railway or other means of transporting ore or material from and to the mine, provided such railway or other means of transportation is used exclusively for the carriage of ore, material, and workmen from and to the mine.

Taxation of Unworked Crown-granted Mineral Claims.

76. The Assessor of every district in which there is situate any Crown-granted mineral claim not producing ore shall prepare a separate roll for the assessment and taxation of the owners of such claims, in which he shall set down:—

(1.) The name and address of the owner of each such claim and the name of such claim:

(2.) The acreage thereof and the amount levied thereon:

(3.) And any other information required by the Minister.

77. There shall be levied and collected by every Collector appointed under this Act from the owner or occupier of every mineral or placer claim situate within his collecting district, of which a Crown grant shall have been issued, including Crown grants issued under the authority of an Act made and passed in the thirty-sixth year of Her late Majesty's reign, intituled "An Act to amend the 'Gold Mining Ordinance, 1867,' and the 'Gold Mining Amendment Act, 1872,'" a tax of twenty-five cents for every acre, and fractional part of an acre, of land conveyed by the grant, which tax shall be payable on the second thirtieth day of June immediately after the date of the Crown grant, and thereafter on the thirtieth day of June in each year: Provided, however, that if the owner of any such claim shall establish, to the satisfaction of the Collector, that the sum of two hundred dollars has been expended upon such claim in mining-development work during the year preceding the date when the tax becomes payable, then the said tax shall not be levied in respect thereof; and in order to entitle the owner to benefit by this provision

he must produce to the Collector a detailed statement showing the nature of the work performed and the amount expended upon the said claim, duly sworn to as true and correct before the Collector or a Justice of the Peace, and this statement must be filed with the Collector on or befort the thirty-first day of August in each and every year in which he claims exemption from the said tax.

78. The tax imposed by the last preceding section shall apply to all mineral or placer claims held by grant from the Crown in any part of the Province, whether the same be situated within or without the boundaries of any municipality; and in all cases where the said tax has been heretofore imposed, or collected, the taxation and collection thereof, and any proceeding taken for sale or forfeiture of the claim or claims for non-payment of the tax, are hereby ratified and confirmed, and the exemption specified in subsection (12) of section 7 of this Act shall not apply to the land included in the Crown grants of mineral and placer claims.

79. Any owner of adjoining Crown-granted mineral or placer claims, not exceeding eight in number of such claims, shall be allowed to perform in mining-development work during the year preceding the date when the tax becomes payable, upon any one or more of such adjoining claims, the full value, at the rate of two hundred dollars per claim, to entitle all of such claims to exemption in lieu of the tax; but subject, however, to the said owner producing to the Collector a detailed statement showing the nature of the work performed and the amount expended, duly sworn to as true and correct before the Collector or a Justice of the Peace, which statement shall be filed with the Collector on or before the thirty-first day of August in each and every year.

80. If the tax imposed by section 77 of this Act shall remain unpaid on and after the thirtieth day of June in any year, the same shall bear interest at the rate of nine per cent. per annum until paid, and the Collector shall, on or before the first day of August thereafter, mail to the last-known address of the owner and registered chargee of such mineral or placer claim a notice stating that the taxes on such claim have become delinquent, and that if not paid within sixty days from the date of such notice the said claim will be advertised and offered for sale at public auction on the first Monday in the following November, of which sale the Collector shall give a notice, in terms hereinafter mentioned, by inserting the same in one issue of the Gazette, and also four consecutive issues of a weekly newspaper, or in one issue a week for four consecutive weeks of a daily newspaper, if there be a newspaper published in his collecting district, or if there be no newspaper published in his district, then in a newspaper published in the next nearest collecting district; and the several publications of such notice shall be before the day of sale. No such notice shall be inserted in the weekly edition of a newspaper if the newspaper has a daily edition.

81. In the notice to be published by the Collector as aforesaid, he shall state the name of the registered owner (or if the Crown grant has not been registered, the name of the Crown grantee), the name and description of the claim, the amount of the unpaid taxes and interest thereon, the costs of advertising and other expenses, and the total amount due, and he shall state that if the total amount due is not paid before the day of sale the claim will be offered for sale by public auction.

82. The tax imposed by section 77 of this Act shall be payable to the Collector of the assessment district in which the claim is situate, and shall be payable in one sum upon the total acreage of the claim, and the Collector shall not receive any proportion of the said tax from any person on account of alleged divided or undivided interests or shares in the said claim, and unless the full amount of the said tax on the total acreage of the claim is tendered no receipt therefor shall be issued.

83. Upon the failure of any one of several co-owners of a mineral claim to contribute his proportion of the tax imposed thereon by section 77 of this Act, any other co-owner may pay the same, and shall thereupon have a right of action against such defaulting co-owner for the proportion of the tax payable by him; and any judgment recovered in any such action shall be deemed to be a judgment within the meaning of section 26 of the "Execution Act," notwithstanding the fact that the sum payable thereby is less than the sum of one hundred dollars.

84. The tax imposed by section 77 of this Act shall form a charge upon the said claim, and the person liable to pay the tax shall be personally liable for the amount thereof, and the Collector may, before offering the claim for sale, in the event of the tax being unpaid in any one year on the first day of October, proceed against the said person in a summary manner

before any Stipendiary Magistrate, Police Magistrate, or Justice of the Peace, who may adjudge the same to be paid; and in default of payment of the amount due, it may, together with costs of distress, be recovered by distress of the goods and chattels of the said person.

85. Any land included within the area of a mineral or placer claim which has been Crown-granted and which is not exempted from the payment of the tax imposed by section 77 of this Act, and which shall be used in whole or in part for any purpose other than for the purpose of mining, shall be treated as real property and be assessed as such in addition to the tax imposed by the said section 77.

86. Where the owner of an unworked Crown-granted mineral claim is also the owner of the surface rights thereof, such surface rights shall be assessed and taxed as real property, and not as wild land, and the tax thereby imposed shall be in addition to the tax imposed by section 77 of this Act, and all taxes heretofore imposed and collected upon unworked Crown-granted mineral claims, either under the said section 77, or upon the surface rights thereof, as wild land or as real property, shall be held to have been legally imposed and collected.

Sale for Delinquent Taxes.

87. (1.) On the day appointed for the public auction of the claim the Collector shall offer the same for sale at the upset price of the total amount due, and he shall sell the claim to the highest bidder.

(2.) If the purchase price shall exceed the upset price, the surplus shall be paid into the Provincial Treasury by the Collector, in trust for the owner of the claim.

(3.) In the event of there being no bidder, or if the price offered shall not be sufficient to pay the amount then due, the claim shall become absolutely forfeited to and vested in the Crown for the use of the Province at the expiration of twelve months from the date of such auction, unless the owner whose name or names appeared, or ought to have appeared, upon the advertised list at the date of such public auction, or his heirs, executors, administrators, successors, or assigns, or any one on his or their behalf and in his or their name, shall pay to the Collector, on or before the expiration of the said twelve months, the taxes, costs, and interest due upon the said claim at the date on which payment thereof is tendered to the Collector.

(4.) The said claim shall not be located under the provisions of the "Mineral Act" or the "Placer-mining Act," and shall not, for the said period of twelve months, be open for pre-emption under the provisions of the "Land Act."

(5.) If the taxes, costs, and interest due upon such claim have not been paid at the expiry of the said twelve months, it shall be absolutely forfeited to and vested in the Crown for the use of the Province, and the Collector shall forthwith issue a certificate in quadruplicate stating that the claim therein specified is absolutely forfeited to the Crown for unpaid taxes, and that the Crown grant thereof is thereby cancelled and void; and the Collector shall retain in his office one of the said quadruplicates and forward one of the said quadruplicates to the Registrar of the land registry district in which the claim is situate, one to the Deputy Minister of Lands, and one to the Surveyor of Taxes and Inspector of Revenue, and they shall each duly register the same in their respective records.

88. On the day of sale the Collector shall issue to the purchaser of any claim sold an interim receipt for the purchase money, in which he shall state that he has sold the claim to the purchaser at the amount declared at such sale, and that if the claim is not redeemed on or before the expiration of twelve months from the day of sale, as before provided, he will execute a deed of conveyance thereof to the purchaser, his heirs or assigns, immediately after the expiration of the said period for redemption, and for which deed the purchaser shall pay to the Collector a fee of ten dollars, which fee shall be paid into the Provincial Treasury.

89. When a claim has been sold at public auction for unpaid taxes and costs, it shall continue to be subject to the tax imposed by section 78 of this Act.

Redemption.

90. (1.) The owner of any claim which may be sold at the said public auction shall have the right to redeem the same, at any time on or before the expiration of twelve months from the day of sale, by tendering to the Collector the full amount due for which the said claim was sold, together with interest at the rate of twelve per centum per annum from the date of sale until the date of tendering payment thereof to the Collector, and the said owner shall also at the same time pay to the Collector any taxes which may have accrued due subsequent to the

date of such sale and interest thereon; and on such tender and payment being made, the Collector shall issue to such owner a certificate that the claim has been redeemed.

(2.) During the said period allowed for redemption, the said owner shall have the right of possession of the said claim as fully as before the said sale, subject, however, to the purchaser at the said sale having the right to protect the same from spoliation and waste during the said period.

91. The Collector, on receiving the tender for redemption, shall at once notify the purchaser that he has received such tender, and request him to return the interim receipt issued to him on the day of sale, and on receipt thereof the Collector shall pay to the said purchaser the amount of the purchase money and interest at twelve per centum per annum so received from the person redeeming. On receiving the said notice from the Collector that the claim has been redeemed, the purchaser shall have no further rights in the claim.

Notice of Forfeiture.

92. When any mineral or placer claim becomes subject to forfeiture to the Crown as hereinbefore provided, the Collector shall forthwith after the date of the public auction give notice to the owner of such claim whose name appeared upon the advertised list, and to all persons who at the date of such public auction appeared on the Land Registry Office records of the land registry district in which the claim is situate as the owners or holders of a registered charge upon the claim, stating that the claim will be absolutely forfeited to the Crown at the expiration of twelve months from the day of the public auction, unless the amounts due as aforesaid are sooner paid; and such notice shall be deemed to have been properly given if mailed to the address of such persons last known to the Collector.

Arrears to be kept distinct from other Taxes.

93. The Collector, when he makes up his assessment roll of assessed taxes each year, and on the certified copy thereof to be forwarded to the Surveyor of Taxes and Inspector of Revenue, shall attach to the said roll a complete list of all the unworked Crown-granted mineral or placer claims in his assessment district, and shall show thereon the amount of taxes due at the thirtieth day of June in each year upon each claim; but the said amounts shall be kept separate and distinct from assessed taxes, and the amounts that may be collected from time to time by the Collector for taxes on such unworked Crown-granted mineral or placer claims shall be accounted for separately in his monthly returns to the Treasury Department, and shall by the Auditor-General be shown as a separate source of revenue in the Public Accounts.

Respecting Surface Rights.

94. Where the surface right of any mineral claim is divided into townsite lots by a plan duly deposited in the Land Registry Office, or where the surface rights are owned or assessed separately from the mineral rights, the Collector may at the sale offer only the mineral under-rights in the Crown-granted mineral claim for sale; and in the event of a new Crown grant being issued to a tax purchaser, the title conveyed shall be limited to the mineral rights only, without any right to the surface.

95. Where any mineral claim situate in a municipality has, as aforesaid, been divided into townsite lots, and the mineral under-rights only have been sold and Crown-granted anew to the purchaser for taxes, it shall be lawful for the Lieutenant-Governor in Council to vest in such municipality any surface rights as to streets, lanes, and highways as shown on such townsite plan that previously appertained to such mineral claim, and which belong to the Crown.

Disposal of Forfeited Mineral Claims.

96. (1.) When a Crown-granted mineral claim has been absolutely forfeited to and vested in the Crown under the provisions of this Act, it shall be lawful for the Gold Commissioner for the mining division in which the claim is situated to grant a lease thereof to any person for the term of one year upon payment of the sum of twenty-five dollars, and, upon payment of a further sum of twenty-five dollars, to grant a renewal of the lease for a further term of one year commencing on the expiration of the former lease, but for no longer period.

(2.) There shall not be granted to any person a lease or any interest in a lease of more than two claims in the same mining division, and a grant of a lease or an interest in a lease in excess of the said number shall be void.

(3.) Such lease shall not be transferable.

(4.) Subject to the rights of any person to the surface or a portion of the surface of such mineral claim, the lessee shall, during the continuance of his lease, but not longer, have the right to enter, prospect, and mine upon such claim for all minerals, precious and base, save coal and petroleum, and for that purpose shall have all the rights of a free miner under the "Mineral Act."

(5.) When the Gold Commissioner has granted a lease to any such person, he shall forthwith notify the Surveyor of Taxes and Inspector of Revenue, giving the name of the claim, the name of the lessee, and the date of the lease, and the Surveyor of Taxes and Inspector of Revenue shall enter the particulars furnished him by the Gold Commissioner in a proper book to be kept by him for that purpose.

(6.) The lessee may, at any time before the expiration of his lease, apply for and obtain a Crown grant of such mineral claim upon payment of all taxes, costs, and interest which remained due and unpaid on such claim on the date of its forfeiture to the Crown, together with all taxes and interest payable in respect thereof from the date of the lease to the date of the application for a Crown grant, but without the payment of any fee for the Crown grant: Provided, however, that if the lessee shall establish to the satisfaction of the Gold Commissioner that he has expended upon such claim in mining development work a sum of not less than two hundred dollars a year during the continuance of the lease, then the tax from the date of the lease to the date of application for a Crown grant shall not be levied or collected.

(7.) The lessee shall be entitled to a Crown grant according to the acreage and description of the claim specified in the original Crown grant thereof under which the claim was held prior to the date of forfeiture, but subject to the prior rights of any other person.

What Taxes are to be assessed, levied, and collected, and Rates of Taxation.

97. There shall be assessed, levied, and collected from every person and paid to His Majesty, his heirs and successors, the sums following, that is to say:—

(1.) On Real Property.

One per cent. upon the assessed value of real property, other than wild land, coal or timber land:

(2.) On Wild Land.

Five per cent. upon the assessed value thereof:

(3.) On Coal Land.

One per cent. upon the assessed value under Class A coal land; four per cent. upon the assessed value under Class B coal land:

(4.) On Timber Land.

Three per cent. upon the assessed value thereof:

(5.) On Income.

On the taxable income of each person, when the amount thereof is ascertained under any of the following classes, the rates shall be as set forth in the respective classes, namely:—

CLASS A.—When the taxable amount of income of each person does not exceed two thousand dollars, upon all taxable income up to and including two thousand dollars, one per cent.:

CLASS B.—When the taxable amount of income of each person exceeds two thousand dollars and does not exceed three thousand dollars, upon all taxable income up to and including three thousand dollars, one and one-half of one per cent.:

CLASS C.—When the taxable amount of income of each person exceeds three thousand dollars and does not exceed four thousand dollars, upon all taxable income up to and including four thousand dollars, two per cent.:

CLASS D.—When the taxable income of each person exceeds four thousand dollars and does not exceed five thousand dollars, upon all taxable income up to and including five thousand dollars, three per cent.:

CLASS E.—When the taxable amount of income of each person exceeds five thousand dollars and does not exceed seven thousand five hundred dollars, upon all taxable income up to and including seven thousand five hundred dollars, four per cent.:

CLASS F.—When the taxable amount of income of each person exceeds seven thousand five hundred dollars and does not exceed ten thousand dollars, upon all taxable income up to and including ten thousand dollars, five per cent.:

CLASS G.—When the taxable amount of income of each person exceeds ten thousand dollars and does not exceed fifteen thousand dollars, upon all taxable income up to and including fifteen thousand dollars, six and one-half of one per cent.:

CLASS H.—When the taxable amount of income of each person exceeds fifteen thousand dollars and does not exceed twenty thousand dollars, upon all taxable income up to and including twenty thousand dollars, eight per cent.:

CLASS I.—When the taxable amount of income of each person exceeds twenty thousand dollars and does not exceed twenty-five thousand dollars, upon all taxable income up to and including twenty-five thousand dollars, ten per cent.:

CLASS J.—When the taxable amount of income of each person exceeds twenty-five thousand dollars, upon all taxable income, twelve and one-half of one per cent.:

(6.) Every person canning, curing, dry-salting, and preserving salmon and other fish shall pay an annual tax of ten cents on every one hundred pounds of such salmon or other fish canned, cured, dry-salted, and preserved in ice during each calendar year; and every person carrying on the business of manufacturing oil from fish, whales, and other sea animals and other products and by-products therefrom shall pay an annual tax of twenty cents on every one hundred gallons of fish and whale oil manufactured, and twenty cents on every ton of fertilizer, whalebone, and bone-meal manufactured by him during each calendar year.

Taxation of Cattle and Sheep depasturing on Crown Lands.

98. The owner or person in charge of any cattle or sheep which are brought into the Province from any place without the Province, and which are depastured on Crown lands, shall pay to the Collector in whose district they are found a tax of seventy-five cents per head on all cattle and a tax of twenty-five cents per head on all sheep so depastured, which tax shall become due and payable forthwith upon such cattle and sheep being depastured, and upon payment of the said tax the owner or person in charge of such cattle or sheep shall be entitled to depasture the same for a period of six months, but no longer.

99. Such tax, if not paid at the office of the Collector in whose district the cattle or sheep are found, shall be payable to the Collector on demand; and if then not forthwith paid, the Collector may, in addition to the powers conferred by section 146 of this Act, levy such tax by distress and sale of a sufficient number of such cattle or sheep to meet the tax and expenses.

Completion of Assessment Rolls.

100. The Assessor of each district, before the completion of each of the several rolls which he is by the provisions of this Act directed and instructed to prepare, shall transmit by post to or leave at the residence or place of business of every person whose address is known to him a notice of the sum or sums for which each such person is assessed and taxed on his "real property," "wild land," "coal land," and "timber land" in the Form No. in the Schedule to this Act, and the Assessor shall transmit by post or leave at the place of residence or business a notice to every person, whose name appears on any of the several rolls, of the sum or sums for which each such person is assessed and taxed on his income, and a notice of any other sum or sums for which he is assessed and taxed generally or specifically under the provisions of this Act in the Form No. in the Schedule to this Act or otherwise as the Minister may direct; and the Assessor shall enter on the roll, opposite the name of the person, the date of delivering or transmitting each such notice, which entry shall be prima facie evidence of such transmission or delivery, and on the back of such notice of assessment there shall be printed a brief summary, for the information of the taxpayer, of the dates when taxes are payable, delinquent, subject to sale or forfeiture, penalties, and any other particulars deemed necessary by the Minister.

101. The insertion by the Assessor of the letters "N.R." in the proper column of the roll, opposite the number on the roll of land assessed to "non-residents," or as "unknown," and the roll being open for inspection of taxpayers at the office of the Assessor for a reasonable time during office hours, shall be deemed to be legal and sufficient notice of assessment and of the amount due therefor to any non-resident whose address is unknown to the Assessor, or to any owner of land assessed as "unknown."

102. Every Assessor shall complete his roll for the assessment and taxation of "real property," "wild land," "coal land," and "timber land" in each year on or before the thirtieth day of November, and shall attach thereto a declaration signed by him, and verified upon affirmation in the form following:—

I, , of , Assessor of Assessment District, do solemnly declare:—

(1.) That I have, according to the best of my information and belief, set down upon the assessment roll all the real property, wild land, coal land, and timber land liable to taxation situate in the Assessment District of , and I have justly and truly assessed each of the parcels so set down at its actual cash value, as it would be appraised in payment of a just debt from a solvent debtor, as prescribed by law.

(2.) That I have set out the real property, wild land, coal land, and timber land in separate parcels upon separate lines of the said roll, as near as may be, and the nature of the tenure thereof.

(4.) I have entered thereon the names of all the owners of "real property," "wild land," "coal land," and "timber land," and of all other persons who have required their names to be entered therein, with the true amount of property occupied or owned by each, and I have not entered the name of any person whom I do not truly believe ought to be entered thereon; nor have I omitted the name or the property of any one whom I knew or had good reason to believe to be entitled to be entered therein, under any Act of the Province.

(5.) The date of delivery or transmitting of the notice required by section 100 of the "Taxation Act" is in every case truly and correctly stated in the said roll, and the amount for which each such person is assessed upon the said roll duly and correctly appears in the said notice delivered or transmitted to him as aforesaid.

And I make this solemn declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the "Canada Evidence Act."

Declared before me at , on }
the day of , 19 . }

.....

103. Every Assessor shall, on or before the first day of April in each year, complete his roll for the assessment and taxation of income, his roll for the taxation of mines and minerals other than coal, and shall attach thereto a declaration signed by him, and verified upon affirmation in the form following:—

I, , of , Assessor of Assessment District, do solemnly declare:—

(1.) That I have, according to the best of my information and belief, set down upon the assessment roll for the assessment and taxation of income in this district the names of all persons who have income liable to taxation in this district.

(2.) That the said assessment roll contains a true statement of the aggregate amounts of the taxable income of every person named in the said roll, and I have estimated and set down the same according to the best of my information and belief.

(3.) That I have, according to the best of my information and belief, set down upon the rolls for the assessment and taxation of mines and minerals, other than coal, the names of all persons liable for the payment of taxes on ore extracted and taken from the mines within this district, and the said assessment roll contains a true statement of the aggregate amount of the tax levied against every person named upon the roll.

(4.) That I have, according to the best of my information and belief, set down on the assessment roll for the taxation of unworked Crown-granted mineral claims the names of the owners of such claims within this district, and that the said roll contains a true statement of the aggregate amount of the tax levied against every person named upon the roll.

(5.) The date of delivery or transmitting of the notice required by section 100 of the "Taxation Act" is in every case truly and correctly stated in the said roll, and the amount for which each such person is assessed upon the said roll duly and correctly appears in the said notice delivered or transmitted to him as aforesaid.

And I make this solemn declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the "Canada Evidence Act."

Declared before me at , on }
the day of , 19 . }

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104. The Assessor of the Victoria Assessment District, before the completion of his roll which he is by the provisions of section 59 of this Act directed and instructed to prepare for the assessment and taxation of certain corporations, and for assessing and taxing persons carrying on the business of canning, dry-salting, and preserving salmon and other fish, and of persons carrying on the business of manufacturing oil from fish and whales and other sea animals and the products and by-products therefrom, shall transmit by post to or leave at the residence or place of business of every person, at his address last given by each such person, a notice of the sum or sums for which each such person is assessed and taxed as shown by and on said roll; and the Assessor shall enter on the roll opposite the name of such person the date of transmission or delivery of each such notice, which entry shall be prima facie evidence of such transmission and delivery; and on the back of such notice of assessment there shall be printed a brief summary for the information of the taxpayer of the dates when taxes are payable, delinquent, subject to sale or forfeiture, penalties, and any other particulars deemed necessary by the Minister.

105. The said Assessor of Victoria Assessment District shall, on or before the first day of April in each year, complete his roll named and described in section 59 of this Act, and shall attach thereto a declaration signed by him, and verified upon affirmation in the form following:—

I, , Assessor of the Victoria Assessment District, do solemnly declare:—

(1.) That I have, according to the best of my information and belief, set down upon the assessment roll for the assessment and taxation of certain corporations, and for the assessing and taxing of persons carrying on the business of canning, curing, dry-salting, and preserving salmon and other fish, and of persons carrying on the business of manufacturing oil from fish and whales and other sea animals and the products and by-products therefrom, the names of all corporations and persons who are liable to taxation under the provisions of sections 54, 55, 56, and 57 of this Act.

(2.) That the said assessment roll contains a true statement of the aggregate amount of the taxable income of every corporation and person named in the said roll, and I have estimated and set down the same and the amount of tax thereon according to the best of my information and belief.

(3.) That I have set down on the said roll, according to the best of my information and belief, the names of all corporations receiving income from premiums for insurance and guarantees, the gross amount of such income (less the amount, if any, paid for reinsurance by each such company), and the amount of tax thereon.

(4.) That I have set down the name of every person carrying on the business of canning, curing, dry-salting, and preserving in ice salmon and other fish, the number of pounds of fish so canned, cured, dry-salted, and preserved in ice by such person, and the amount of taxes thereon.

(5.) Also the name of every person carrying on the business of manufacturing oil from fish and whales, the number of gallons of oil so manufactured by him, and the tax thereon.

(6.) Also the name of every person manufacturing fertilizer, whalebone, bone-meal, or other product or by-product of fish, whales, and other sea animals, the number of pounds of each such product, respectively, and the amount of tax thereon.

(7.) The date of delivery or transmitting of the notice required by section of the "Taxation Act" is in every case truly and correctly stated in the said roll, and the amount for which each such person is assessed upon the said roll truly and correctly appears in the said notice delivered or transmitted to him aforesaid.

And I make this solemn declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the "Canada Evidence Act."

Declared before me at , on }
the day of , 19 . }

.....

106. Any person liable to pay income-tax and any person whose returns have to be made to the Assessor of the Victoria Assessment District under the provisions of sections 54, 55, 56, and 57 of this Act, whose fiscal year is not the calendar year, may with the permission of the Minister make his return or returns to have the taxes payable by such person computed upon the basis of his income and products for the twelve months ending with the last fiscal year of such person preceding the date of assessment, and the Assessor shall govern himself accordingly.

Additional Powers.

107. Where necessary, under the provisions of this Act, for the Assessor to make a supplementary roll to any annual roll, he shall prepare such supplementary roll in accordance with the form of the annual roll to which it is a supplement, and shall add in a conspicuous place thereon the word "supplementary."

108. The Assessor may from time to time, either before or after a revision of the roll, or of any separate or supplementary roll in respect of any assessment or tax,—

(*a.*) Correct any clerical error:

(*b.*) Place thereon the name of any person of whose liability to taxation he is satisfied:

(*c.*) Add to any roll the value of any property or the amount of any income omitted to be assessed against or returned by any person at the time and in the manner required by law:

(*d.*) Place thereon the value of any property or the amount of any income owned, held, or received or receivable by any person or company which he is satisfied is liable to be assessed for taxation:

(*e.*) Place thereon the amount, or balance of any amount, of tax for which any person is liable, which has not been entered in any previous roll or which has not been previously demanded.

109. The Assessor shall, within ten days from the date of such amended assessment, give notice thereof to the person affected thereby; and every such person shall be entitled to object, and to have the objection heard before the Court of Revision and Appeal, which Court shall have the power to sit from time to time to hear and determine such objections and to deal with the amount of such assessment. Notice in writing of any such objection must be given by the person making the same to the Assessor within fourteen days from the date of the Assessor's notice, and in any action thereon or procedure thereto the provisions of section 94 of this Act shall apply.

110. Any additions, alterations, or changes, as provided in section 108 hereof, shall be reported by the Assessor to the Surveyor of Taxes and Inspector of Revenue, provided such additions, changes, or alterations have not been inserted in the roll before the final revision of the roll.

111. The assessment roll, completed and added up, with the Assessor's declaration and the certificate of the Judge of the Court of Revision and Appeal and of the Assessor attached, shall be deposited in the office of the Collector, and in such other place as the Lieutenant-Governor in Council shall in that behalf from time to time appoint, and at all convenient office hours, for a reasonable time, shall be open to the inspection of all the taxpayers resident, owning, or in possession of property in the assessment district.

Courts of Revision and Appeal.

112. The Lieutenant-Governor in Council may from time to time appoint three persons, who are residents of the assessment district for which they are appointed, to be a Court of Revision and Appeal in respect of the assessment of land and real property as aforesaid for such district, and such persons shall record the proceedings of the said Court and deposit such records with the Assessor. The person first named in such appointment shall be Senior Judge of such Court unless or until ordered otherwise by the Lieutenant-Governor in Council.

113. The Lieutenant-Governor in Council may from time to time appoint one or more persons in any assessment district to be a Court of Revision and Appeal in respect of the assessment of income and property other than land and real property as provided for in this Act, and such person or persons shall record the proceedings of the said Court and deposit such records with the Assessor.

114. Any Court so appointed may sit and adjourn from time to time at pleasure.

115. The said Court or some member thereof shall administer an oath or affirmation to every person or witness before his evidence can be taken, and may issue a summons to any witness to attend such Court.

116. If any witness so summoned fails to attend, he shall incur a penalty not exceeding twenty-five dollars, to be recoverable, with costs, before one or more Justices of the Peace in a summary way.

117. At the time or times appointed, the said Court shall meet and try all complaints in regard to persons wrongly placed upon or omitted from the roll, or assessed at too high or at too low a sum, and in regard to any error, omission, or invalidity made or arising in the assessment roll or in any of the proceedings leading up to or subsequent to the preparation of the roll.

118. Upon an appeal upon any ground against an assessment, the Court of Revision may reopen the whole question of the assessment, so that omissions from and errors and invalidities in the assessment roll, or in any of the proceedings leading up to or subsequent to the preparation of the roll, may be corrected, and the accurate amount for which the assessment should be made may be determined, and the person or persons who should be assessed therefor may be placed upon the roll by the said Court.

119. Provided always that when any owner of real property held and used for agricultural, horticultural, or pastoral purposes of not less than twenty acres in area, and which is assessed at a value of more than twenty-five dollars per acre, makes an appeal against the assessment made by the Assessor, and makes a sworn statement as to the value of the said real property based on its rental value, the Court of Revision may fix the assessment at any value over twenty-five dollars per acre which is based on its rental value capitalized at eight per cent.

120. When it shall appear to the Court of Revision that there are omissions from or errors or invalidities in the rolls or in any of the proceedings leading up to or subsequent to the preparation of the roll, and there is no appeal before such Court against the assessment in question, the said Court may extend the time for making complaints fourteen days further, and may then meet and determine the matter, and the Assessor may for such purpose be the complainant.

121. All the duties of the Court of Revision which relate to the assessment of real property shall be completed and the assessment rolls (except supplementary assessment rolls) finally revised by such Court on or before the twenty-first day of December in each year, or on or before such other day in every year as the Lieutenant-Governor in Council may from time to time appoint.

122. All the duties of the Court of Revision which relate to all assessment rolls, except that in relation to the assessment of land and real property, and except supplementary rolls, shall be completed and such assessment rolls finally revised by such Court on or before the first day of April in each year, or on or before such other day in every year as the Lieutenant-Governor in Council may from time to time appoint.

123. The proceedings for trial of complaints shall be as follows:—

(1.) Any person complaining of an error or omission in regard to himself, as having been wrongfully inserted on or omitted from the roll, or as having been undercharged or overcharged by the Assessor in the roll, may, personally or by his agent, within fourteen days after the date of mailing or delivery (if the notice has not been mailed) of the Assessor's notice of assessment as provided in this Act, give notice in writing to the Assessor that he considers himself aggrieved for any or all of the causes aforesaid, otherwise such person's right to appeal shall cease and the assessment made shall stand:

(2.) If any person who is assessed in or for the assessment district thinks that any other person has been assessed too low or too high, or has been wrongfully inserted on or omitted from the roll, the Assessor shall, on request of such first-mentioned person in writing, delivered to the Assessor within fourteen days before the date of holding the Court of Revision, give notice to such other person of the time when the matter will be tried by the said Court; and the matter shall be decided in the same manner as complaints by a person assessed:

(3.) The Assessor shall post up in some convenient and public place within the district a list of all the complainants, on their own behalf, against his return, and of all complainants on account of the assessment of other persons, stating the names of each, with a concise description of the matter complained against, together with an announcement of the time when the said Court will be held to hear the complaints, or to which it may be adjourned from time to time for that purpose; but no alteration shall be made in the roll unless under a complaint formally made according to the above provisions:

(4.) When it shall appear that there are palpable errors which need correction, the said Court may extend the time for making complaints fourteen days further, and may then meet and determine the additional matter complained of, and the Assessor may, for such purpose, be the complainant:

(5.) Such lists may be in the following form:—

Appeals to be heard at the Court of Revision at , on the day of , 19 .

Appellant.	Respecting whom.	Matter complained of.
A B.	Self	Overcharged on land.
C. D.	E. F.	Name omitted.
G. H.	J. K.	Not bona-fide owner or occupant.
L. M.	N. O.	Property undercharged.
etc.	etc.	etc.

(6.) The said Court shall also advertise in the Gazette and in some newspaper published in the district, and if there be no such paper, then in some newspaper published in the nearest district in which one is published, or by posting notice in some conspicuous place within the district, the time at which the Court will hold its sitting for the year, and the advertisement shall be published at least ten days before the time of such sitting:

(7.) The said Court shall prepare a notice in the form following for each person with respect to whom a complaint has been made:—

To J. K.:

Take notice that you are required to attend the Court of Revision at , on the day of , in the matter of the following appeal:—

H. G.,
Appellant.

Subject.—That you are not a bona-fide owner or occupant [*or as the case may be*].

Dated the day of , 19 .

(Signed.) *X. Y.,*
Judge of the Court of Revision.

(8.) Such notice shall be mailed to such address of the person as was last known to the said Court:

(9.) Every notice hereby required, whether by publication, advertisement, letter, or otherwise, shall be made at least ten days before the sittings of the said Court:

(10.) If the party assessed complains of an overcharge on his personal property or income, he or his agent may appear before the said Court and make a declaration, in case the complainant appears in person, in the Forms Nos. 10, 11, and 12 in the Schedule to this Act, according to the fact; and if the complainant appears by agent, such agent may make the declaration in the Forms Nos. 13 and 14 in the said Schedule, as the case may be; and no abatement shall be made from the value of personal property or income unless in accordance with the exemptions or deductions allowed by this Act; and the said Court shall thereupon enter the person assessed at such amount of personal property or income as is specified in such declaration, unless such Court shall be dissatisfied with the declaration, in which case the party making the declaration, and any witnesses whom it may be desirable to examine, may be examined on oath by such Court respecting the correctness of such declaration; and such Court shall confirm, alter, or amend the roll as the evidence shall seem to warrant:

(11.) In other cases the said Court, after hearing upon oath the complainant and the Assessor or Assessors, and any witness adduced, and, if deemed desirable, the party complained against shall determine the matter, and confirm or amend the roll accordingly; and in all cases before the said Court it may increase the assessment or change it by assessing the right person, the Court giving the latter or his agent fourteen days' notice of such assessment, within which time he must appeal to the said Court if he objects to such assessment:

(12.) If either party fails to appear, either in person or by an agent, the Court may proceed ex parte.

124. The said Court shall also, during its sitting, with or without notice, receive and decide upon the petition from any person assessed who declares himself, from sickness or extreme poverty, unable to pay the taxes for the then current year, or who, by reason of any gross or manifest error in the roll, as finally passed by the said Court, has been overcharged more than twenty-five per cent. on the sum he ought to have been charged for the previous year only. The said Court may remit or reduce the taxes due for such periods by any such person, or reject the petition.

125. All moneys to be assessed, levied, or collected under this Act for the public use of the Province shall, if not otherwise provided by any Act now or hereafter to be passed, be calculated, assessed, levied, and collected upon the assessments as shown on the several rolls prepared in accordance with the provisions of this Act, and as finally revised, and the Judge or Judges of each Court of Revision and Appeal and the Assessor of each assessment district shall, under their hands, certify to the correctness of the rolls for each such district.

126. Every roll, as finally passed and certified to by the said Judge or Judges of the said Court and the said Assessor, shall, except in so far as the same may be further amended on appeal to the Court of Appeal, be valid and bind all parties concerned, notwithstanding any defect, error, omission, or invalidity committed or existing in or with regard to such roll, or in or with regard to any of the proceedings leading up to or subsequent to the preparation of the roll.

127. When an assessment roll has been finally revised, the Assessor shall forthwith transmit to the Surveyor of Taxes and Inspector of Revenue a certified copy thereof, and in no case shall this transmission be later than sixty days after such final revision of the roll without the special consent of the Minister.

Special Courts of Revision and Appeal.

128. The person or persons appointed by the Lieutenant-Governor in Council under sections 112 and 113 of this Act may, on the request of the Assessor, hold special Courts of Revision and Appeal to hear and determine all appeals arising out of the assessment made by him under this Act, or out of any special, separate, or supplementary assessment rolls made by him in virtue of this Act; and notice of the holding of such special Courts of Revision and Appeal shall be given by the Assessor in one issue of the Gazette and in a newspaper published in the assessment district (if any) at least fourteen days before the holding of such Court; and the Assessor shall also give notice to the appellant at least fourteen days before the holding of such Court, of the time and place when and where the Court is to be held.

Appeal to Court of Appeal.

129. Notwithstanding anything contained in this Act, an appeal from the Court of Revision and Appeal shall lie to the Court of Appeal against any action or decision of the said Court of Revision, and also against any omission, neglect, or refusal of the said Court of Revision to hear or decide any matter. The notice of such appeal to the Court of Appeal, the time for bringing the same on and the procedure generally, and the powers of the Court of Appeal in respect of such appeal shall be the same as in the case of an ordinary appeal to the Court of Appeal from any judgment of a Judge of the Supreme Court. In addition to the powers above mentioned, the Court of Appeal shall have all the powers by this Act conferred upon the Court of Revision and Appeal.

Defects and Omissions.

130. If from any default or neglect an assessment roll for any year is incomplete, for the purpose of being finally revised by the Court of Revision and Appeal, it shall be lawful for the Lieutenant-Governor in Council to direct that the assessment roll for the year previous shall be taken and adopted in lieu of such incomplete roll.

131. If it appears to the Assessor that any land liable to assessment has not been assessed for all the year for which it was liable to assessment, he shall enter such lands upon the roll for the current year, or upon a supplementary roll for the current year, and assess such land for the years for which it is liable for assessment, but for which it had not theretofore been assessed, and at an assessed value equal to the average assessed value of the three previous years of land of similar nature and quality in his assessment district; and the taxes payable thereon shall be calculated for the whole period for which the land was liable to assessment, at the rate of taxes current for the year of assessment, and the said taxes shall be entered upon the roll in one amount, and which amount shall be considered as the tax due for the current year; and the Assessor shall mark upon the roll, and upon the assessment notice, immediately after the description of the land, that the tax shown due includes the taxes for the years omitted.

132. If, after the final revision of the current year's roll, the Assessor should discover that any person has escaped taxation (other than upon land), for which such person would have

been liable had he been assessed and taxed, he shall, upon a supplementary roll for the current year assess and tax such person for the amounts omitted, according to the information then had and obtained, but for a period limited to ten years preceding the date of such supplementary roll; and due notice of such assessment shall be given to such person, who shall have the right to appeal to the special Court of Revision at its next or some subsequent meeting after said notice of assessment has been given, and such appeal shall be lodged with the Assessor within fourteen days after the date of the notice of assessment. Before making such assessment, the Assessor shall have the right to examine the taxpayer on oath or otherwise, and to demand and obtain production of the taxpayer's books, papers, and accounts, and to examine the same. If after such examination it is proved that the taxpayer has wilfully evaded just taxation, or withheld correct information for the due assessment for which he would have been liable during any portion of the said period, the taxpayers shall be liable in the penalties mentioned in sections 24, 25, and 26 of this Act; but if the omission has been caused unintentionally by the taxpayer, he shall be liable for the correct taxes only, and he shall have no right to claim that all the taxes for which he had been assessed had been paid in full by any official receipts which he may produce, if the omitted amounts, or any balance thereof, are not included therein.

Payment and Collection.

133. All taxes assessed and levied under the provisions of this Act, except such taxes the date for the payment of which is otherwise specifically fixed and provided for herein, shall be due and payable on the first day of May in each year immediately following the year for which the assessment was made, and if not paid on or before the thirtieth day of June next following the said first day of May shall bear interest at the rate of nine per centum per annum until paid or received.

134. The person liable to pay the taxes imposed by this Act shall be personally liable for the amount thereof.

135. The taxes due upon any land, with costs and interest, may be recovered from the owner originally assessed therefor, and shall be a special charge on the land, having preference over every claim, privilege, charge, or encumbrance of every person except the Crown, and the charge and its priority shall not be lost or impaired by any neglect, omission, or error of the Assessor, or of any agent or officer, or by want of registration. Payment of taxes may be enforced against the person liable therefor by distress, as provided by section 146 of this Act, by action, as provided by section 191 of this Act, or by both distress and action.

136. Where any land upon which taxes are due to the Province has been included within the boundaries of any municipality heretofore created, or which may hereafter be created, or within any extension thereof, the Collector shall have the same powers for the recovery of such taxes, by public sale, by distress, or by action, conferred by this Act, as if the said lands had not been so included within such boundaries.

137. All taxes payable under this Act shall be payable at the office of the Collector appointed for the collecting district in which the same are due, and may be paid to the Collector either in gold coin, silver (to the extent only of twenty dollars by one person at one time), bank-notes issued by any chartered bank in Canada, marked bank-cheques, post-office money-orders, postal notes, or express orders; and where payment is tendered by cheque or orders, they shall be made payable to the Collector of the collecting district free of exchange, cost of remittance, or other charges; and the tax shall not be deemed paid, notwithstanding any receipt given therefor, until the amount of such cheque or order shall have been collected by the Collector.

138. In the month of May in each year the Collector shall, by advertisement or notice published in the Gazette and a newspaper, if there be a paper published in his district, and posted on the outer door of his office, give notice that the taxes are due and payable at his office. The publication of such notice in the Gazette shall be deemed to be equivalent to a personal demand by the Collector of all taxes due or payable by persons liable to pay the same.

139. The Collector of every district shall keep a triplicate blank receipt-book, and on receipt of any sum of money for taxes shall deliver to the party making payment one of such receipts, and shall transmit to the officer in charge of the Treasury the second of the set, with the corresponding number, retaining the third of the set in the book; the transmission of such

receipts shall be made to the officer in charge of the Treasury at least every month; and the officer in charge of the Treasury shall file such receipts.

140. In case there should be arrears of real-property tax, personal-property tax, or income-tax due by a taxpayer, and he should desire to pay off a portion of the said arrears before proceedings are taken for recovery thereof, the Collector may accept any amount tendered, but the amount so tendered shall in no case be less than one full year's tax, with interest thereon at the rate of nine per centum per annum to the date of payment; and the Collector shall apply the said amount to clear off the furthest back year or years in arrears (as the case may be), and grant a receipt therefor, and he shall state upon such receipt what amount is still due and owing by such taxpayer for real-property, personal-property, or income tax. If satisfactory proof is adduced to the Collector that any parcel of land on which taxes are due has been subdivided, and the plan of such subdivision duly registered in the Land Registry Office, he may receive the proportionate amount of tax chargeable upon any of the subdivisions, and leave the other subdivisions chargeable with the remainder, and the Collector may, in his books, divide any piece or parcel of land which may have been returned to him in arrear for taxes into as many parts as the necessities of the case may require.

141. The Collector shall, on demand, give to the owner of any land charged with arrears of taxes, or to any other person making application therefor, a written statement of the arrears, or that there are no arrears (as the case may be), at that date, and he may charge twenty-five cents for the search on each separate lot or parcel not exceeding four, and for every additional ten lots a further fee of twenty-five cents; but the said Assessor shall not make any charge for search to any person who forthwith pays the taxes.

POWERS AND PROCEDURE FOR ENFORCING PAYMENT OF TAXES.

Delinquent Taxes.

142. All taxes on real property, personal property, and income which became due on the first day of May in each year, remaining unpaid on the following thirty-first day of December, shall be deemed to be delinquent on the said thirty-first day of December.

143. All taxes which became delinquent at the date mentioned in the last preceding section shall thereupon bear interest at the rate of nine per centum per annum from such date until paid or recovered; such added interest shall be deemed a charge upon the property of the person whose taxes are delinquent, in all respects as if the said interest had originally formed part of the taxes assessed thereon, and may be recovered as a part of the delinquent taxes.

144. All taxes unpaid on the thirty-first day of December are hereby declared delinquent and shall bear interest at the rate of nine per centum per annum from that date until paid or recovered, and such added interest shall form a charge upon the property of the person whose taxes are delinquent, in all respects as if the said interest had originally formed part of the taxes assessed thereon, and may be recovered as a part of the said delinquent taxes; and any proceedings which may have been taken for recovery thereof under any Act of this Province heretofore in force, by public sale or otherwise, are hereby declared to be valid and of full force and effect.

145. The Collector, or any other person authorized by the Lieutenant-Governor in Council, is hereby fully authorized and empowered to sell property by public auction for taxes.

By Distress.

146. In case any person neglects to pay his taxes or any part thereof after demand or publication of notice as aforesaid, the Collector may, by himself or by his agent, levy the same with costs, by distress of the goods and chattels of the person who ought to pay the same, or of any goods and chattels in his possession, wherever the same may be found within the Province.

147. The Collector shall, by advertisement posted up in at least three public places in the district wherein the sale of the goods and chattels distrained is to be made, give at least ten days' public notice of the time and place of such sale, and of the name of the person whose property is to be sold; and at the time named in the notice the Collector or his agent shall sell at public auction the goods and chattels distrained, or so much thereof as may be necessary.

148. If the goods and chattels seized have been sold for more than the amount of the

taxes and costs, and if no claim to the surplus be made by any other person, on the ground that he was entitled by lien or other right to the property, such surplus shall be returned to the person in whose possession the property was when the distress was made and his receipt taken therefor.

149. If any such claim be made by the person for whose taxes the property was distrained, and the claim is admitted, the surplus shall be paid to the claimant and his receipt taken therefor.

150. If the claim is contested, such surplus money shall be retained by the Collector until the respective rights of the parties have been determined by action at law or otherwise.

151. (1.) If the Collector has not deemed it advisable to exercise the right of distress conferred upon him by section 146 of this Act, or in default of sufficient distress for the recovery of delinquent taxes, he shall, on a day to be fixed by the Minister between the fifteenth day of July and the fifteenth day of October in any year, levy all or any part of such delinquent taxes as the Minister may by any writing under his hand direct, together with all costs, interest, and charges, by sale of the lands in his collecting district of the persons liable for the said taxes.

(2.) To cover the costs of advertising and other expenses connected with the sale of Crown-granted mineral or placer claims or of lands for unpaid taxes, the Assessor shall charge each parcel of land advertised for sale with the sum of two dollars, and no more, and this sum shall be included in the column of the advertisement set apart for costs and expenses.

(3.) Where land has been subdivided into lots such as town lots, villa lots, and other small subdivisions, and where the same are advertised for sale for unpaid taxes, the charge of two dollars for advertising and costs mentioned in the last preceding section shall not be charged and added, but in lieu thereof the sum of one dollar shall be charged against each parcel as advertised to cover the costs of advertising and sale, and the Collector may in such advertisement include all the lots owned by one person in a particular subdivision in one parcel in such advertised list and offer the same for sale in one parcel.

152. In the case of lots in townsites, villas, or other small subdivisions of property, where taxes thereon are delinquent, they may, at the discretion of the Minister, be withheld from tax sale.

153. (1.) Subject to subsection (3), the lands of any member of the Allied Forces, as defined in section 2 of the "Allied Forces Exemption Act, 1918," shall be withheld from tax sale.

(2.) The lands of the father, mother, wife, or children of any such member of the Allied Forces, if dependent on him, may, at the discretion of the Minister, be withheld from tax sale.

(3.) This section shall not be deemed to in any way affect the power to assess or tax the property of any person under this Act; nor shall this section invalidate the sale of any land for taxes, or prevent the giving of a deed thereunder for any land sold where neither the Minister, nor the Assessor, nor the Collector has actual notice that any person having an interest in the land sold is entitled to the benefit of this section. In all notices of sale for taxes the Collector shall express his readiness to receive notice from any source of the interests of those entitled to the benefit of this section. Where, either by inadvertence or ignorance of the facts, lands of a person entitled to the benefits of this section are sold, the Minister may at any time prior to the delivery of the tax-sale deed cancel the sale in so far as it affects such lands, and refund to the purchaser the amount paid by him, with interest at six per centum per annum from the date of the payment; and thereupon the amount for which such lands were sold, together with interest from the date of sale, shall be and continue to be a lien upon the lands as if the tax sale had not taken place, and shall thereafter be deemed to be delinquent taxes within the meaning of this Act.

Procedure and Duties of Collector before and at the Sale.

154. (1.) The Collector shall cause to be published a notice of such tax sale as follows: By inserting in one issue of the Gazette and also in four consecutive issues of a weekly newspaper, or in one issue a week for four consecutive weeks (the same day in each week) of a daily newspaper, if there be a newspaper published in his collecting district, or if there be no newspaper published in his district, then in a newspaper published in the next nearest collecting district; and the several publications of such notices shall be before the day of sale.

(2.) In such notice the Collector shall state in several columns:—

(*a.*) The names of the assessed persons:

(*b.*) A short description of the properties of the assessed persons upon which the taxes are levied (which description shall be given as the lot, portion of lot, section, portion of section, block, township, range, group, or other division by which the land is commonly known):

(*c.*) The amounts of the delinquent taxes and interest to the date of sale:

(*d.*) The costs and expenses of such sale, including the costs of advertising:

(*e.*) The total amounts due; and

shall, subject to the provisions of subsection (3), further state that if the total amount due in any case be not sooner paid he will on a certain named date offer the property upon which the taxes are levied for sale at public auction.

(3.) In any case, if so directed by the Minister, the Collector shall also state in such notice that upon payment before the time of sale of such part of the delinquent taxes as may be directed by the Minister, together with interest thereon and the costs and expenses, the property upon which such taxes are levied may be withdrawn from sale.

(4.) In case any property is withdrawn from sale under subsection (3), such withdrawal shall not, nor shall any levy or any proceedings had for the sale of such property, affect or in any way prejudice the recovery of the part of such delinquent taxes remaining unpaid by any means or proceedings provided in this Act for the recovery of delinquent taxes.

155. It shall not be necessary for the Collector, when giving notice of the sale of land for unpaid taxes by advertisement or otherwise, to give in the said notice the full legal description of the land to be exposed for sale, but it shall be sufficient for the purposes of this Act for him to give in such notice a short description of such land; such short description shall be made so as to make the location of the land clear to the taxpayer and to the general public, and he shall not be required to state in such notice that the land is improved or unimproved.

156. It shall not be the duty of the Collector of any district to make inquiry before effecting a sale of lands for taxes to ascertain whether or not there is any distress upon the land, nor shall he be bound to inquire into or form any opinion of the value of the land; and if any tax in respect of the lands sold by the Collector in pursuance and under the authority of this Act shall have been due, and the land shall not be redeemed within the period herein allowed for redemption, such sale and the official deed to the purchaser of any such lands shall be final and binding upon the former owners of the said lands, and upon all persons claiming by, through, or under them, it being intended by this Act that all owners of land shall be required to pay the delinquent taxes and interest, costs, commissions, and all expenses due thereon within the time herein mentioned, or redeem the land within the period herein provided for.

157. (1.) If the taxes, interest, costs, and expenses have not been previously paid, or if no person appear to pay the same at the time and place appointed for the sale, the Collector may, at the place, day, and hour appointed sell the land of the assessed person as described in the said notice to the highest bidder.

(2.) The Collector shall offer each parcel of land as described in the said notice separately at an upset price, which upset price shall be the total amount due as set out in the third column of the said notice. In the event of there being no bid over the upset price, the person bidding the upset price shall be declared the purchaser.

158. If at any time appointed for the sale of lands the Collector should find it impracticable to finish the sale on the day appointed, he may adjourn the same from day to day until finished, but he shall not adjourn the same for a longer period than two days at one adjournment.

159. If the purchaser of any parcel of land fails immediately to pay the Collector the amount of the purchase money, the Collector shall forthwith again put up the property for sale.

160. Every purchaser, at the time of the sale and before he is given the certificate of sale, shall sign the tax-sale list, setting out his full name, occupation, and post-office address, and such list shall be preserved by the Collector with all the other books, documents, and papers connected with such sale.

Occupied Crown Lands not to be sold.

161. The Collector shall not sell any land the fee of which is in the Crown, but where taxes are delinquent thereon a final demand shall be made giving the pre-emptor, lessee, licensee, locator, or other person in whose favour a pre-emption, lease, licence, or location has been issued six months from the date when the said taxes have become delinquent, together with

the then current year's taxes, in which to pay such delinquent taxes and interest, together with the then current year's taxes, and notice that if not paid the pre-emption record, licence, lease, or location shall be cancelled; such final demand shall be made by the Collector on or before the first day of June in each year after the taxes become delinquent.

162. Failing payment of the delinquent taxes and interest, together with the then current year's taxes, by the pre-emptor, lessor, licensee, or locator within the said six months, the Collector shall forward to the Minister of Lands a detailed list of all defaulting pre-emptors, lessors, licensees, or locators, and the said Minister shall at once cancel the said pre-emptions, leases, licences, or locations: Provided, however, that if good reasons can be adduced to the satisfaction of the Minister of Lands that the defaulting person from poverty, sickness, or other cause has been unable to pay the amount due within the time limited, he may extend the time within which payment shall be made for a further period of six months before cancellation takes effect.

163. (1.) Until the Minister of Lands has notified the Collector that cancellation has taken place, the Collector shall not cancel the amount due upon his assessment roll or arrears-book, and he shall continue to assess the lands upon his roll until such notice of cancellation has been given.

(2.) The Minister of Lands shall, as soon as cancellation is made, notify the Collector of the fact, and the Collector shall then cancel the amount due, and leave off the assessment roll the property which has been so cancelled.

(3.) The Collector shall, within thirty days from the date of the notification of cancellation by the Minister of Lands, forward a detailed list of the lands and taxes cancelled on the Collector's rolls and books to the Surveyor of Taxes and Inspector of Revenue.

Procedure after Sale and Rights of Purchasers.

164. (1.) When a sale of land is made for unpaid taxes, the Collector shall give a statement in detail with each certificate of sale, showing the amount of taxes, interest, and costs included in the purchase price thereof, and if there is a surplus over the upset price realized he shall state the amount of such surplus thereon, and forward a copy of the certificate and statement to the Deputy Minister of Finance.

(2.) The Deputy Minister of Finance, on receiving such statement, shall place the said surplus to the credit of the person whose land was sold, and hold the same in trust for him until he redeems the land as hereinafter provided, or if he does not redeem the land within the period limited for such redemption, then such surplus shall be paid over to the said person, or his legal representatives, without interest.

165. When the Collector sells land for taxes, he shall within thirty days thereafter mail a letter, addressed to the person assessed on the roll, informing him of the name of the purchaser, the amount for which the land was sold, and the date on which the period allowed for redemption will expire, and the Collector shall also within six months after the sale of land for taxes give notice by letter, to any person or persons who at the time of the sale appeared on the Land Registry Office records as the owner or holder of a registered charge on or owning an equity in the land so sold, of the sale of the land and of the date on which the period allowed for redemption will expire; and such notice shall be deemed to be properly given if mailed to the last-known address of the person or persons above described to be notified by the Collector.

166. The Collector, after selling any land at public auction as aforesaid, shall give a certificate under his hand to the purchaser, describing the land sold as advertised, the sum for which it was sold, the costs and expenses, and the surplus (if any), and further stating that a deed conveying the same to the purchaser or his assigns will be executed by him, on the demand of the purchaser, at any time after the expiraton of two years from the date of sale, if the land be not previously redeemed, upon payment of the fee hereinafter provided.

167. The purchaser at such tax sale shall, where the land is not in occupation by the owner, his tenant, or any one entitled to redeem, on receipt of the Collector's certificate of sale, have all necessary rights of action and powers for protecting the same from spoliation and waste until the expiration of the term during which the land may be redeemed, but he shall not knowingly permit any person to cut timber growing upon the land or otherwise injure the land, nor shall he do so himself: Provided that the purchaser shall not be liable for damage done without his knowledge to the property during the time that the certificate of sale is in force.

Disposition of Surplus Proceeds of Sale.

168. In the event of there having been a surplus over the upset price at the time of the said sale paid by the purchaser, and which surplus stands to the credit of the person entitled to redeem upon the books of the Provincial Treasury, the Collector shall deduct the said amount so standing to the credit of the said person from the amount required by him for redemption, but without allowing interest thereon; and from the person so entitled to redeem the Collector shall accept the amount of the upset price, together with any taxes that may have been advanced by the purchaser during the period allowed for redemption, and together with interest at the rate of twelve per centum per annum on the said upset price, on the money advanced for taxes, and also upon the said surplus (which sums together represent the actual moneys paid by the purchaser).

169. In the event of there being no redemption, the said surplus shall be paid to the person entitled to redeem, or his legal representatives, without interest, on written application therefor to the Deputy Minister of Finance.

Result of no Sale being made.

170. (1.) If the Collector fails to sell any assessed property at such public auction or adjournment thereof at the upset price, or at a sum greater than the upset price, the assessed property shall become absolutely forfeited to and vested in the Crown for the use of the Province, free from all encumbrances, at the expiration of twelve months from the date of such public auction or adjournment thereof, unless the owner whose name appears on the advertised list at the date of such public auction, or a chargee, or the heirs, executors, administrators, successors, or assigns or either of them, or any one on his or their behalf, and in his or their name, shall pay to the Collector, on or before the expiration of the said twelve months, the following amounts, namely: the taxes, interest, and costs shown due upon the said advertised list on the said assessed property at the date of such public auction, with interest thereon to the date when payment is tendered, together with all taxes and interest accrued due subsequent to the date of such public auction, up to and including the date upon which payment is tendered.

(2.) During the said period of twelve months the said assessed property shall be assessed and taxed in the name of the person appearing on the said advertised list, and if payment of the amounts above set forth is not made to the Collector on or before the expiration of the said twelve months, he shall within one month from the expiry of the said twelve months issue a certificate under his hand, in quadruplicate, setting out that the assessed property mentioned therein had been publicly exposed for sale for delinquent taxes, and that no sale having been effected, and the amounts due being still unpaid, the assessed property is thereby absolutely forfeited to and vested in the Crown for the use of the Province, free from all encumbrances; and the Collector shall retain in his office one of such quadruplicates and he shall forward one of the remaining quadruplicates to the Registrar-General, or District Registrar of Titles of the land registry district in which the assessed property is situate, one to the Deputy Minister of Lands, and one to the Surveyor of Taxes and Inspector of Revenue, and they shall register the same in their respective records.

(3.) When the Collector has issued the said certificates he shall cancel upon his books the amount due upon such assessed property, marking thereon that the assessed property has been forfeited to the Crown.

(4.) Assessed property which has become subject to forfeiture as above provided shall not, during the said period of twelve months, be again advertised for sale for unpaid taxes.

171. In the case of lands where no sale has been effected at the public auction, and thereby becoming subject to forfeiture to the Crown as hereinbefore provided, the Collector shall, within one month after the date of the public auction, give notice in writing to the assessed person whose name appeared on the advertised list, and to each person who at the date of such public auction appeared on the Land Registry Office records of the land registry district in which the land is situated as the owner or holder of a registered charge upon the land, that the land will be absolutely forfeited to the Crown at the expiration of the said twelve months, unless the amounts due to the Province for taxes, interest, and costs on said land, as hereinbefore provided, are sooner paid; and such notice shall be deemed to have been properly given if mailed to the address of such persons last known to the Collector.

172. (1.) Lands which have been forfeited to and vested in the Crown under the provisions of this Act shall not be open for pre-emption under the "Land Act," nor for location under the "Mineral Act" or "Placer-mining Act," and such lands may be sold or leased by the Minister of Lands to any person at a price or rental not less than the price or rental of lands of similar nature and quality under the "Land Act," and upon such terms and conditions and subject to such reservations as he may consider right in the interest of the Province.

173. (1.) In the event of any land having been erroneously forfeited to the Crown, the Minister of Lands is hereby authorized and empowered to reinstate the assessed person, his heirs, executors, administrators, successors, or assigns, in the title under which the land was held at the date of forfeiture, free of all costs, but subject, however, to the payment by him or them to the Collector of all taxes and interest due upon the land at the date of forfeiture, and of a sum equal to the taxes which would have accrued due up to the time of reinstatement had the said land been regularly assessed at the same annual value as it appeared upon the assessment roll for the year previous to the date of forfeiture.

(2.) On production to the Minister of Lands of the Collector's receipts showing that the full amount required to be paid has been paid, the Minister of Lands shall cause the entry of forfeiture upon his records to be cancelled, and notify the said Registrar of Titles and Surveyor of Taxes and Inspector of Revenue to cancel upon their respective records the entry of forfeiture thereon.

Redemption.

174. The owner of any land which shall be sold for unpaid taxes, or his heirs, executors, administrators, or assigns, or any other person in his or their behalf, may, at any time within two years from the day of sale, redeem the land sold, by paying or tendering to the Collector, for the use and benefit of the purchaser or his legal representatives, the sum paid by him, including any taxes thereon advanced by the said purchaser since the day of sale, together with interest at twelve per centum per annum thereon; and the Assessor shall give to the party paying such redemption money a receipt, stating the sum paid and the object of the payment, and such receipt shall be evidence of the redemption.

175. Upon payment or tender being made for redemption of any land sold at public sale, it shall be the duty of the Collector to forward by registered letter to the last-known post-office address of the purchaser thereof at the said public sale a notice in writing stating that such property has been so redeemed, and that the amount to which he may be entitled out of the amount so paid in redemption shall be paid to him on production and delivery of the certificate of sale.

176. From the time of a tender to the Collector of the full amount of redemption money required by this Act, the said purchaser shall cease to have any further right in or to the land in question.

Pending Redemption.

177. During the period allowed for redemption, or until redeemed, the land shall continue to be assessed and taxed to the owner at the time the land was advertised for sale, and he shall be liable for the taxes thereon, and the same shall form a charge upon the land, and if he redeems the land the taxes accrued during said period of redemption shall be paid along with and at the same time as the amount required for redemption; and if the purchaser at the tax sale shall deem it expedient to pay the taxes which become due during the period of redemption upon the said land, he may do so, and in that event the amount so paid by him shall be added to the amount required to redeem the land.

178. In the event of any land being sold at a tax sale and not having been redeemed, the taxes accrued due during the period allowed for redemption shall, if unpaid at the time of the delivery of the deed to the purchaser, be paid by the said purchaser.

179. A purchaser at a tax sale shall have right to appeal from the assessment of the property purchased by him and to appear before the Court of Revision in support thereof, as if he were the owner of the property as recorded on the assessment roll.

Tax-sale Deeds.

180. At any time within the period allowed for redemption of land sold for taxes, the owner or any person holding a registered charge on or any one having an equity in such land may take

action by proceedings in the Supreme Court of this Province to have the sale of such land set aside upon any of the following grounds and no other:—

(*a.*) That the sale was not conducted in a fair or open manner; or

(*b.*) That the taxes for the year or years for which the land was sold had been paid; or

(*c.*) That the land was not liable to taxation for the year or years for which it was sold.

181. If any such sale be set aside or be declared invalid or any of the grounds set forth in the last preceding section, the Collector shall, within sixty days after the decision of the Supreme Court setting aside or declaring invalid such sale has been given, pay over to the purchaser of the land sold to him at such sale the full amount paid by such purchaser, with interest at the rate of nine per cent. per annum from the date of such sale to the date of such payment by the Collector; and if any such sale be set aside or declared invalid on the ground that such sale was not openly or fairly conducted, then and in such event the amount of the taxes and interest thereon for which such land was sold, together with interest on such taxes at the rate of nine per cent. per annum from the date of such sale, shall nevertheless be and continue to be a lien upon the land and shall be deemed to be delinquent taxes.

182. If the sale of land for taxes be not set aside or declared invalid for the reason:—

(*a.*) That the taxes for the year or years for which the land was sold had been paid; or

(*b.*) That the land was not liable to taxation for the year or years for which it was sold; or if

(*c.*) The land be not redeemed within the period so allowed for its redemption as aforesaid,—

then, on the demand of the purchaser, or his assigns, or other legal representative, at any time afterwards, and on payment of ten dollars, the Collector shall prepare, execute, and deliver to him or them a deed of the land sold, in which deed any number of lots in any one district may be included at the request of the purchaser or any assignee of the purchaser.

183. Such deed shall be in the Form No. 16 in the Schedule to this Act, or to the same effect, and shall state the date and cause of the sale and the price, and shall describe the land as herein provided, and shall vest in the purchaser all rights of property, in fee-simple or otherwise, which the person assessed, or those claiming under him, had in such land, and shall also purge and disencumber such land from all payments, charges, liens, mortgages, and encumbrances of whatever nature and kind other than existing liens for taxes, and other than the reservations and exceptions subject to which the person assessed, or those claiming under him, held the said land, and the Registrar-General or District Registrar of Titles, upon production of the deed and application in the usual form, and payment of the usual fees, shall register or record the same in the usual manner.

184. (1.) In any proceedings in any Court in this Province a deed purporting to be issued for a sale of lands for arrears of taxes, and purporting to be executed in the manner provided by this Act, shall be prima facie evidence that such deed is the tax-sale deed which it purports to be, and that the sale alleged in the said deed was conducted in a fair and open manner, and that there were taxes due and in arrear upon the land described in the said deed at the time of the sale for which the same could be sold.

(2.) In case any tax-sale deed is lost or destroyed, if the Collector of the assessment district in which the deed was prepared and executed is satisfied by affidavit or otherwise of the facts of the loss or destruction of the deed, the Collector may prepare, execute, and deliver to the purchaser at the tax sale, or his assigns or other legal representative, a confirmation tax-sale deed in lieu of the missing deed. The confirmation deed shall be a duplicate of the original tax-sale deed, with a recital added of the fact of the loss or destruction of the original tax-sale deed, and such confirmation deed when executed and delivered under this section shall in all proceedings in any Court in the Province and for all purposes of the "Land Registry Act" be of the same force and effect as if it were the original tax-sale deed. A fee of ten dollars shall be paid by the applicant to the Collector for a confirmation tax-sale deed.

185. A tax-sale deed shall, in any proceedings in any Court in this Province, and for the purposes of the "Land Registry Act," be conclusive evidence of the validity of the assessment of the land and levy of the rate, the sale of the land for taxes, and all other proceedings leading up to the execution of such deed; and notwithstanding any defect in such assessment, levy, sale, or other proceedings, no such tax deed shall be annulled or set aside.

186. The Collector shall, in all certificates and deeds given for land sold at a tax sale, give, as far as possible, a description of the part or proportion sold, with sufficient certainty, and if less than a whole lot or section, then by such a general description, as far as possible, as may enable a surveyor to lay off the piece sold on the ground; and he may search, if necessary, in the Land Registry Office to ascertain the description and boundaries of the whole parcel, and he may also obtain a surveyor's description of such lots, to be taken from the Land Registry Office or the Government maps where a full description cannot otherwise be obtained, such surveyor's fee not to exceed five dollars; and the charges so incurred shall be included in the account and paid by the purchaser of the land sold, or the party redeeming the same.

187. The Collector of each district shall enter in a book a full description of every parcel of land conveyed by him to purchasers for delinquent taxes, with an index thereto, and shall keep the same amongst the records of his office.

188. In any action brought by the Minister under this Act, it shall be sufficient if the action is brought by the Minister as plaintiff, and it shall not be necessary to name the said Minister, and the action shall not abate by reason of a change in the person of the said Minister, but the action may proceed as though no change had been made. In any such action the said Minister shall have the same right, either before or after the trial, to require the production of documents, to examine parties or witnesses, or to take such other proceedings in aid of the action as a plaintiff has or may take in an ordinary action.

189. In case of liquidation or insolvency of any person upon which a tax is levied under this Act, the amount unpaid of such tax shall be a first lien or charge upon the estate of such person in favour of the Crown for the benefit of the Province, subject to the provisions of any Statute of the Dominion and to the charges of liquidation and insolvency proceedings.

190. The taxes imposed by this Act upon every owner of a mine, both in respect to his income and in respect to the tax imposed on the product of his mine, shall constitute a lien in favour of the Crown, not only upon the output of the mine, but also upon the mine and mining premises wherefrom the same was extracted, and upon all ore, minerals, or mineral-producing substances extracted therefrom which may be on the premises. The Collector shall have all the like powers for collection by distress or by sale of the mining premises as are conferred by this Act for the recovery of taxes either upon real or personal property, and such powers may be exercised cumulatively.

General Powers applicable to all Cases.

191. If the taxes, or any part thereof, payable by any person cannot be recovered in any special manner provided by this Act, they may be recovered with interest and costs, as a debt due to the Crown, for the use of the Province, in which case the production of a copy of so much of the Collector's roll as relates to the taxes payable by such person, purporting to be certified as a true copy by the Assessor, shall be prima facie evidence of the debt.

PART II.

Taxation of Railways and Railway Subsidy Lands.

Interpretation.

192. Where the words following occur in this Part of this Act they shall be construed as follows unless from the context a contrary intention appears:—

"Company" means a railway company, and includes any person having authority to construct and operate a railway:

"Railway" means any railway which the company has authority to construct or operate, and includes all branches, sidings, spurs, and switches, stations, depots, wharves, rolling-stock, equipment, stores, property, real or personal, and works connected therewith, and also any railway bridge, tunnel, or other structure which the company is authorized to construct:

"Rolling-stock" means and shall include any locomotive, engine, motor-car, tender, snow-plough, flanger, and every description of car or of railway equipment designed for movement on its wheels over or upon the rails or tracks of the company.

Application of this Part.

193. This Part of this Act shall not apply to any real property of a railway company which is situate within the limits of any municipality in the Province.

194. This Part of this Act shall not apply to street railways operated by electricity within municipalities.

195. This Part of this Act shall not apply to railways used exclusively for the carriage or transportation of logs, ores, or coal, or of workmen employed by the owner of such logs, ores, or coal to and from their place of work, if they are carried free of charge.

Returns to be made by Companies.

196. Every company shall annually transmit, on or before the fifteenth day of October in every year, to the Surveyor of Taxes and Inspector of Revenue a return on forms to be supplied by him, showing:—

(1.) Under what Acts of the Province the company claims exemption from taxation upon its real and personal property and income, the date of the completion of the railway, the date of selection of the lands granted under any Acts of the Province, the dates of such grants and the acreage included therein:

(2.) The total number of miles of track of main line and branches, including sidings, spurs, and switches, of the railway company situated within the Province, and specifying the mileage claimed to be exempt from taxation under any Act of the Province and the mileage within the limits of any municipality in the Province:

(3.) Any other real property of the company liable to taxation other than that occupied by the company for its right-of-way or buildings connected with the actual operation of the railway.

197. (1.) Every company shall annually transmit, on or before the respective days hereinafter in this section specified, to the Surveyor of Taxes and Inspector of Revenue, returns on forms to be supplied by him, as follows, namely:—

(*a*.) On or before the fifteenth day of January in each year, a return showing all lands sold, agreed to be sold, pre-empted, or leased within the limits of the grants that are held by the company under any land grant or subsidy Act of the Province during the period of three months preceding the date of the return, namely, from the first day of October to thirty-first day of December:

(*b*.) On or before the fifteenth day of October in each year, a return showing all lands sold, agreed to be sold, pre-empted, or leased within the limits of the said grants during the period of nine months preceding the date of the return, namely, from the first day of January to thirtieth day of September.

(2.) Each of such returns shall show in detail and in tabulated form the legal descriptions of the land, number of acres sold or agreed to be sold, pre-empted, or leased, name of person to whom sold or agreed to be sold or leased, or by whom pre-empted, date of deed, agreement, pre-emption, or lease, and the consideration mentioned therein.

(3.) The lands mentioned in subparagraphs (*a*) and (*b*) of subsection (1) of this section shall be assessed and taxed as real property, or as wild land, coal land, or timber land, as the case may be, in accordance with the provisions of Part I. of this Act.

Penalty for failing to make Returns.

198. Every company failing to transmit the returns required by this Part of this Act shall be liable to a penalty of fifty dollars for each day during which failure, neglect, refusal, or delay in transmitting the said returns continues, to be recovered in a summary way by proceedings at the instance of the Minister before any Stipendiary Magistrate, Police Magistrate, or Justice of the Peace; and, in addition to such penalty, to the payment of all taxes which would have been payable under this Act had such returns been duly transmitted.

Rate of Taxation.

199. (1.) The land occupied and claimed as the right-of-way by any company and the railway with the personal property and income of the company derived from its railway, and its rolling-stock, shall be assessed and taxed as a whole as real property, the rate of taxation

to be two per cent. of the assessed value, and the assessed value shall be at the sum of ten thousand dollars per mile and fractions thereof of the track of the main line and branches of the company.

(2.) The measurement of the track of the main line and branches shall not include sidings, spurs, and switches, but all sidings, spurs, and switches of the railway shall be assessed and taxed as real property, and the assessed value thereof shall be at the sum of three thousand dollars per mile and fractions thereof.

(3.) In the event of the company erecting or having erected within or upon the land occupied and claimed as the right-of-way any building, structure, or portion of same, or other improvement which is used for other than railway purposes, such building, structure, or portion of same, or improvements, shall be separately assessed and taxed as real property, under the provisions of Part I. of this Act.

Liability of Companies.

200. Every such company shall be liable for the taxes levied under Part I. of this Act upon all the lands mentioned in section 197 of this Act, so long as the company is the owner of such lands, if such lands are not otherwise exempt from taxation under any Act of this Province, and the lands pre-empted, agreed to be sold or leased, mentioned in the said section 197, shall be assessed and taxed to the company as owner, and to the person named in the returns furnished by the company under the said section as occupant, jointly, under the provisions of the said Part I. of this Act.

201. Save as in this Part of this Act provided, the provisions of the other Parts of this Act governing the assessment, levy, due date, and proceedings for recovery of taxes on land and real property shall apply to the recovery of the taxes imposed by this Part of this Act.

202. The Lieutenant-Governor in Council is hereby empowered to grant to any railway company an exemption from the assessment and tax imposed by section 199 of this Act for a period not exceeding ten years from the date of completion of any railway which may be completed after the first day of January, 1908, and the date of such completion shall mean the date of the certificate of the Engineer of the Department of Public Works that the railway is open for traffic and passengers. A detailed statement of all such exemptions shall be submitted to the Legislative Assembly within the first fifteen days of each ensuing session thereof: Provided that such exemption shall only be granted on the express conditions—

(1.) That no aliens shall be employed on the railway during construction, unless it is demonstrated to the satisfaction of the Lieutenant-Governor in Council that the work cannot be proceeded with without the employment of such aliens:

(2.) That every exemption from taxation granted under this Act shall be subject to the conditions that the workmen, labourers, or servants employed in or about the construction and operation of the railway in aid of which such exemption from taxation is granted shall be paid such rate of wages as may be currently payable to white workmen, labourers, and servants engaged in similar occupations in the district in which such railway is constructed and operated.

PART III.

MISCELLANEOUS MATTERS.

Duties and Liabilities of Agents and Trustees.

203. Every agent for every person permanently or temporarily absent from or not resident in the Province, and every trustee:—

(1.) Shall be answerable for the doing of all such acts, matters, or things as are required to be done by virtue of this Act for the assessment of the property or income which he represents, or which is the subject of his trust, or which is received by him or comes to his hand, and for paying the tax in respect thereof:

(2.) Is hereby authorized to recover from any person in whose behalf he is compelled to pay any tax the amount so paid by him:

(3.) Is hereby authorized and required to retain, from time to time, in each year, out of any money which shall come to him in his representative character, so much as shall

be sufficient to pay the tax for the then current year when assessed therefor, and any arrears of taxes in respect of any property or income subject to such tax whilst acting as agent therefor, and is hereby indemnified for all payments which he shall make in pursuance of this Act:

(4.) Is hereby made personally liable for the tax payable in respect of any property or income if, while such tax remains unpaid,—

(*a.*) He shall alienate, charge, or dispose of such property; or

(*b.*) Dispose of any fund or money which shall come to him in his representative character;

and shall not be otherwise personally liable for any tax imposed upon him under this section.

204. The Collector, or any other person or authority empowered under this Act, shall have such and the like remedies against all land or other property of any kind vested in or under the control or management of any agent or trustee as he would have against the land or property of an individual, and in as full and ample a manner.

Failure and Inability to collect Taxes.

205. In case the Collector fails or omits to collect the taxes or any portion thereof, the Lieutenant-Governor in Council may authorize the Collector, or some other person in his stead, to continue the levy and collection of the unpaid taxes, in the manner and with the powers provided by law for the general levy and collection of taxes; but no such authority shall alter or affect the duty of the Assessor or Collector to return his roll, or shall in any manner whatsoever invalidate or otherwise affect the liability of the Collector or his sureties.

206. If any personal-property tax or income-tax shall become delinquent, and there is not any real property of the person owing such delinquent taxes upon which the same may be levied, or if there is no personal property belonging to such person which can be distrained therefor, or in default of sufficient distress, the Collector shall, within three months after the tax shall have become delinquent, forward to the Surveyor of Taxes and Inspector of Revenue a statement showing that every effort has been made to recover the tax, that there is no property or effects, or insufficient property or effects, or that the person assessed has left the country, and giving a detailed list of such irrecoverable taxes; and the Surveyor of Taxes and Inspector of Revenue shall, if he is so instructed by the Minister, cause the said taxes to be cancelled upon the books of the Collector.

207. Where taxes on land owned by the Crown, held under pre-emption or agreement, have become irrecoverable from the persons liable therefor, the Surveyor of Taxes and Inspector of Revenue may authorize the Collector to cancel on his books the amounts due therefor.

The Surveyor of Taxes and Inspector of Revenue.

208. It shall be the duty of the Surveyor of Taxes and Inspector of Revenue, and his deputy, under the direction of the Minister, to see that the provisions of this Act are carried out by the Assessors, Collectors, and taxpayers, and to prepare all rules, regulations, and forms necessary for that purpose, and the Surveyor of Taxes and Inspector of Revenue and his deputy shall have all the powers conferred upon Assessors under this Act.

Powers of the Lieutenant-Governor in Council.

209. It shall be lawful for the Lieutenant-Governor in Council in each year to cause to be paid to every person appointed under this Act such sums as he shall think fit for the purpose of carrying out the provisions of this Act.

210. In order to promote and facilitate the collection and recovery of taxes, and to give full and due effect to the meaning and intent of this Act or any amendment thereof, and of the Schedule of Forms to this Act, the Lieutenant-Governor in Council may from time to time make and discharge such rules and regulations as may, in his opinion, be necessary or desirable for carrying out the spirit, intent, and meaning of this Act in relation to matters for which no express provision has been made, or for or in respect of which only partial or imperfect provision has been made; or when the time limited for any act or step is insufficient, or where, by accident or otherwise, such act or step has not been taken, or it shall appear to the Lieutenant-Governor in Council that an alteration in dates is necessary or desirable, or where any proceeding under

this Act, or intended so to be, has been taken and failed, or if, in the opinion of the Lieutenant-Governor in Council, any ambiguity or difficulty shall arise in the construction of or in applying this Act, or if any change of practice, procedure, or method may be deemed desirable, the Lieutenant-Governor in Council may, by rules or regulations, from time to time make and promulgate such enlargement, extension, or alteration in times or dates as he may see fit; and any such rules or regulations shall be published in at least one issue of the Gazette, and shall have the force of law.

211. (1.) If any act, matter, or thing required by this Act to be made, performed, or done by the Assessor, Collector, or other officer appointed to carry out the provisions of this Act at or within a fixed time cannot be or is not so made, performed, or done, the Lieutenant-Governor in Council may, by Order, appoint a further or other time for making, performing, or doing the same, whether the time within which the same ought to have been done has or has not elapsed or expired.

(2.) Any act, matter, or thing made, performed, or done within the time prescribed by such Order in Council shall be as valid as if it had been made, performed, or done within the time fixed by or under this Act.

212. The Lieutenant-Governor in Council may make new forms or vary or alter any of the forms to this Act as the exigencies of the public service may render necessary.

Respecting Certificates of Improvements and Crown Grants.

213. The Minister of Lands shall not complete nor deliver, or cause to be delivered, any certificate of improvements or Crown grant under the "Land Act" until the person entitled thereto shall lodge with him a certificate from the Collector that all taxes due upon the land mentioned in the said certificate of improvements or Crown grant have been fully paid up to the end of the previous year.

214. The Collector shall, upon request of the person entitled to such certificate or Crown grant, furnish him, free of charge, with such certificate, stating that the taxes (if paid) have been paid.

General Provisions.

215. The forms of returns in the Schedule of Forms to this Act, when filled up by taxpayers, shall not be open for inspection by any person, except the Lieutenant-Governor in Council and the officers duly appointed under this Act, and by the Legislative Assembly of the Province.

216. Every roll shall be the property of the Province, and every Collector shall, upon application, deliver up the same to the Provincial Secretary, or some person authorized by him to receive the same.

217. If any person wilfully tears down, injures, or defaces any advertisement, notice, or other document which is required by this Act to be posted in a public place for the information of persons interested, he shall, on conviction thereof in a summary way before a Justice of the Peace having jurisdiction in the district, city, or town, be liable to a fine not exceeding fifty dollars, to be recovered in a summary manner.

218. All penalties recovered under this Act shall be paid to the Minister and shall form part of the Consolidated Revenue Fund.

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A BRIEF ACCOUNT OF THE REVENUE SITUATION IN THE PROVINCE OF BRITISH COLUMBIA, WITH SOME COMMENTS AND SUGGESTIONS

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A PRELIMINARY REPORT

TO

THE TAXATION BOARD

OF THE PROVINCE OF

BRITISH COLUMBIA

By

ROBERT MURRAY HAIG, PH.D.

Assistant Professor of Economics, Columbia University.

TAXATION BOARD.

(Appointed under authority of Chapter 64, Laws of 1917.)

J. B. McKilligan, *Chairman.*

W. G. Cameron.

Thomas Kidd.

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LETTER OF TRANSMITTAL.

COLUMBIA UNIVERSITY, IN THE CITY OF NEW YORK,

December 31st, 1917.

J. B. McKilligan, Esq.,

Chairman, Taxation Board, Parliament Buildings, Victoria, B.C.

SIR,—I have the honour to submit to you for the consideration of the Taxation Board and the Government a report entitled "A Brief Account of the Revenue Situation in the Province of British Columbia, with some Comments and Suggestions," which was prepared from material gathered during my recent visit to the Province.

Very truly yours,

ROBERT MURRAY HAIG.

PREFACE.

During the summer of 1917 the writer received a communication from the Honourable H. C. Brewster, Premier of the Province of British Columbia, stating that he was about to appoint a Taxation Board which would attempt to place the revenue system of the Province upon a more satisfactory basis. Correspondence followed, which resulted in an invitation extended through the Honourable John Hart, Minister of Finance, to act as adviser to the Taxation Board and to the Government in connection with the proposed changes in the tax law.

The situation was felt to be so acute as to make an immediate investigation imperative. Through the kindness of President Nicholas Murray Butler and Professor J. C. Egbert, Director of the School of Business, the writer secured a brief leave of absence from duties at Columbia University and arrived at Victoria on November 6th, remaining three weeks, until November 27th. A cursory examination revealed a situation so full of difficulties and complications as to preclude the possibility of accomplishing in the time available more than a preliminary survey. It was decided, however, that the work should proceed, even though it was hopeless to expect that it would be carried to the point where a definite and comprehensive set of conclusions and recommendations could be formulated. This explains why this report is more a fragmentary outline than a definite statement giving the results of an exhaustive survey.

The pressure of time made it impossible to travel about the Province investigating first-hand the conditions of administration and the effects of the present distribution of the tax burden. Much valuable information, however, was presented at the hearings held at the Parliament Buildings in Victoria on November 21st, 22nd, and 23rd, which the writer had the privilege of attending. Except for these three days, the period was consumed in the study of documentary material and in conferences with the members of the Taxation Board, members of the Government, and various Provincial officials.

To Mr. John B. McKilligan, who for so many years has guided the development of taxation in the Province and who was honoured by being made Chairman of the Taxation Board, the writer desires to acknowledge a debt of gratitude. In spite of the heavy pressure of duties in his office, he gave with great generosity his time and effort to this investigation; without the aid of his exhaustive and accurate knowledge of the history and the application of the tax law, it may be frankly stated that progress with this study would have been most discouragingly slow. To the Minister of Finance, to the members of the Taxation Board, and to the many persons in the various departments who kindly assisted him in gathering material, the writer extends his hearty thanks. Finally, he would express his appreciation of the generous interest taken in the problem by Professor Edwin R. A. Seligman, of Columbia University, with whom the writer has had the great privilege of conferring.

A BRIEF ACCOUNT OF THE REVENUE SITUATION IN THE PROVINCE OF BRITISH COLUMBIA.

SOME ASPECTS OF THE GENERAL FINANCIAL SITUATION IN THE PROVINCE.

The Desirability of a Definite Formulation of Financial Needs.

Little progress can be made in the direction of a satisfactory solution of the taxation problem of British Columbia until knowledge has been secured of the fiscal needs of the Province and a definite financial plan adopted. This is because the size of the sum which must be raised by levying taxes has a profound effect upon the type of taxation which is best suited to the circumstances. It happens that in British Columbia at the present time the exact determination of the amount to be raised by taxation is an unusually difficult and delicate task. Not only are conditions so uncertain as to make estimates of ordinary incomes subject to a wide margin of error, but on the expenditure side, also, uncertainty is present to an unusual degree. The Government is apparently making strenuous efforts to reduce expenditure, but how material will be the results upon the financial problem cannot at this time be definitely foretold.* Finally, the important contingent liabilities which may soon become actual and pressing financial demands upon the Provincial Treasury are uncertain in amount. In view of these circumstances it will be readily understood why there was reluctance to furnish a definite statement of the amount which must be raised by taxation.

It is very important that this amount be made definite at as early a date as possible not only because the tax programme can then be more exactly formulated, but also because the uncertainty is doubtless responsible for much of the present dissatisfaction with the tax system. Rates have been increased to the point where tax-paying is a very appreciable burden, and in some cases the yields apparently promise to be substantially greater than the estimates.† This naturally gives rise to a feeling on the part of the taxpayers that they are being taxed in a sweeping and unjust fashion without reference to needs for revenue.‡ Until it is possible to speak with some degree of certainty regarding financial necessities, this element of dissatisfaction cannot be eliminated. When it is possible to lay down a definite financial programme, the Government can demand, and will doubtless receive, more willing assistance from the taxpayers in carrying it out.

The Shrinkage in Revenues.

That the present financial stress is not a sudden development, but is the result of the operation of policies which have been in force during a series of years, is made plain by an examination of the financial records. In Table I. the attempt is made to classify the receipts for recent years in accordance with their general character as taxes, fees, subsidies, etc.§

---

* How far it is politically possible to carry a policy of retrenchment in British Columbia is an unanswered question.

† E.g., in the cases of the amusement-tax and the income-tax.

‡ This attitude of mind was evident from the testimony of a number of witnesses at the hearings—e.g., D. G. Marshall, K.C., *cf.* Record of Public Sessions of Taxation Board, page 5.

§ For a discussion of the desirability of classification and of the principles upon which the classification in Table I. is based, *cf.* Appendix A, *infra*, page 127. It has not been the custom to classify the receipts in the Public Accounts. Moreover, many of the items are entered under obscure titles. As a result it is impossible without somewhat elaborate analysis to gain a clear conception of the significance of the figures. The figures represent cash receipts. The data for the year 1916-17 are from manuscript, but for the earlier years are from the "Comparative Statement of the Receipts and Expenditures" published in the Public Accounts.

Table I.—Comparative Statement of Receipts, Province of British Columbia, 1905, 1910-17

	1904-5.	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.	1916-17.
I.—*Subsidies from Dominion.*	$ 29,151 06	$ 29,151 06	$ 29,151 06	$ 29,151 06	$ 29,151 06	$ 29,151 06	$ 29,151 06	$ 29,151 06	$ 29,151 06
	35,000 00	150,000 00	150,000 00	180,000 00	180,000 00	180,000 00	180,000 00	180,000 00	180,000 00
Annual payment of interest	142,925 60	142,925 60	142,925 60	304,629 60	323,338 40	313,984 00	313,984 00	313,984 00	313,984 00
" subsidy	100,000 00	100,000 00	100,000 00	100,000 00	100,000 00	100,000 00	100,000 00	100,000 00	100,000 00
" grant *per capita*	.....	100,000 00	100,000 00	100,000 00	100,000 00	100,000 00	100,000 00	100,000 00	100,000 00
" for lands conveyed	.....	.....	.....	.....	.....	.....	.....	.....	.....
" special grant ("B.N.A. Act, 1907")	$307,076 66	$522,076 66	$522,076 66	$713,780 66	$732,489 46	$723,135 06	$723,135 06	$723,135 06	$723,135 06
Totals									
II.—*Income from the Public Domain.*									
Canneries and whaling tax (royalty) (included under personal property).									
Land-sales	$141,510 83	$2,618,188 75	$2,431,231 36	$1,805,390 71	$2,344,596 52	$1,172,953 72	$749,098 31	$119,772 48	$218,453 47
Mineral-tax (royalty)	114,236 77	102,608 93	91,038 43	100,659 29	155,163 36	153,880 73	130,876 68	163,335 58	287,257 59
Rents (other than lands)	28 50	109 00	230 00	350 00	210 25	206 00	75 00	65 00	17,737 43
Royalty and tax on coal	94,682 45	222,722 91	248,382 86	195,207 78	302,225 35	192,590 14	158,867 25	173,261 75	194,536 62
Timber (leases)	76,228 17	85,875 29	106,857 75	83,066 04	84,576 39	114,545 38	79,952 42	126,470 01	75,990 11
Timber (licences)	410,288 29	2,234,099 31	2,357,951 32	2,300,263 28	2,457,129 37	244,179 06	1,755,119 64	1,477,378 26	192,176 31
Timber (royalty)									567,292 85
Timber-sales	.....	.....	.....	.....	.....	.....	47,469 45	71,875 84	85,357 26
Water revenue	.....	.....	.....	45,619 24	49,984 03	61,909 54	27,597 11	59,908 13	33,971 73
Totals	$836,975 01	$5,263,604 19	$5,235,641 72	$4,530,556 34	$5,393,885 27	$4,140,264 57	$2,949,055 86	$2,192,076 05	$2,672,773 37
III.—*Fees.*									
Boiler inspection fees	.....	$ 19,614 62	$ 20,827 04	$ 26,454 46	$ 28,829 81	$31,288 81	$26,857 31	$24,327 05	$28,309 36
Bureau of Mines	$ 1,709 50	687 00	917 00	662 50	863 00	1,977 51	929 79	884 25	870 50
Commission and fees on tax sales	103 30	.....	.....	.....	.....	.....	.....	.....	.....
Fees under "Moving Pictures Act"	.....	.....	.....	.....	.....	.....	23,940 50	17,715 50	18,429 86
Fines and Court fees	12,524 95	30,734 60	46,203 69	48,215 15	63,358 47	64,955 56	41,033 46	20,117 15	21,968 12
Fishery and cannery licences	.....	31,340 00	82,657 79	26,988 67	32,170 00	39,702 18	34,648 92	33,335 00	38,563 50
Free miners' certificates	53,504 04	53,095 07	68,937 86	68,101 21	62,985 70	59,591 25	56,651 75	47,920 80	48,875 25
Game licences	.....	7,280 00	7,815 00	7,995 00	6,175 00	218,525 92	127,469 53	81,117 53	79,919 19
Land revenue	159,412 55	175,778 11	321,586 98	323,895 21	301,184 95	100,626 56	101,963 90	81,178 41	65,949 02
Law-stamps	12,607 90	24,500 20	30,992 30	43,817 13	73,569 33	.....	.....	.....	.....
Licences, commercial travellers	7,250 00	700 00	200 00	.....	.....	45,861 73	75,728 52	81,680 01	76,581 17
Log-scaling fees	.....	21,698 75	27,518 64	27,239 61	25,210 93	18,375 60	29,821 59	29,439 38	40,897 85
Licences, taxes, and fees ("Fire Insurance Act")	.....	.....	.....	.....	36,609 08	24,485 00	19,520 00	16,070 00	15,020 00
Marriage licences	6,610 00	17,490 00	17,580 00	21,200 00	25,850 00	92,919 65	62,969 35	59,277 85	62,315 61
Mining receipts (general)	105,192 21	91,253 75	105,319 55	93,461 70	94,754 35	44,810 23	40,250 77	64,505 49	72,695 47
Probate fees	10,613 53	19,463 86	37,294 41	30,111 23	43,743 52	96,420 65	64,814 90	37,949 66	44,983 50
Registration of companies	.....	.....	.....	173,401 20	141,957 55	652,431 48	443,727 67	241,548 50	196,663 90
Registry fees	93,012 29	408,826 15	613,092 22	592,398 73	712,258 43	20,163 83	17,144 72	15,496 33	10,100 56
Survey fees	1,092 90	15,871 85	18,052 97	17,544 59	22,053 48	1,220 00	870 00	730 00	170 00
Tax-sale deeds	1,580 00	510 00	560 00	430 00	520 00	102,617 96	90,629 11	75,924 98	67,386 87
Trade and liquor licences	53,663 06	58,951 49	92,498 00	75,545 36	86,207 60	107,154 50	90,948 25	71,582 00	66,097 50
Traffic tolls	16,140 35	29,901 35	23,817 81	21,500 00	23,000 00	23,000 00	22,500 00	26,000 00	26,394 99
Totals	$535,016 53	$1,007,696 80	$1,515,871 26	$1,598,961 75	$1,781,801 20	$1,746,127 42	$1,372,400 04	$1,016,799 89	$982,192 22

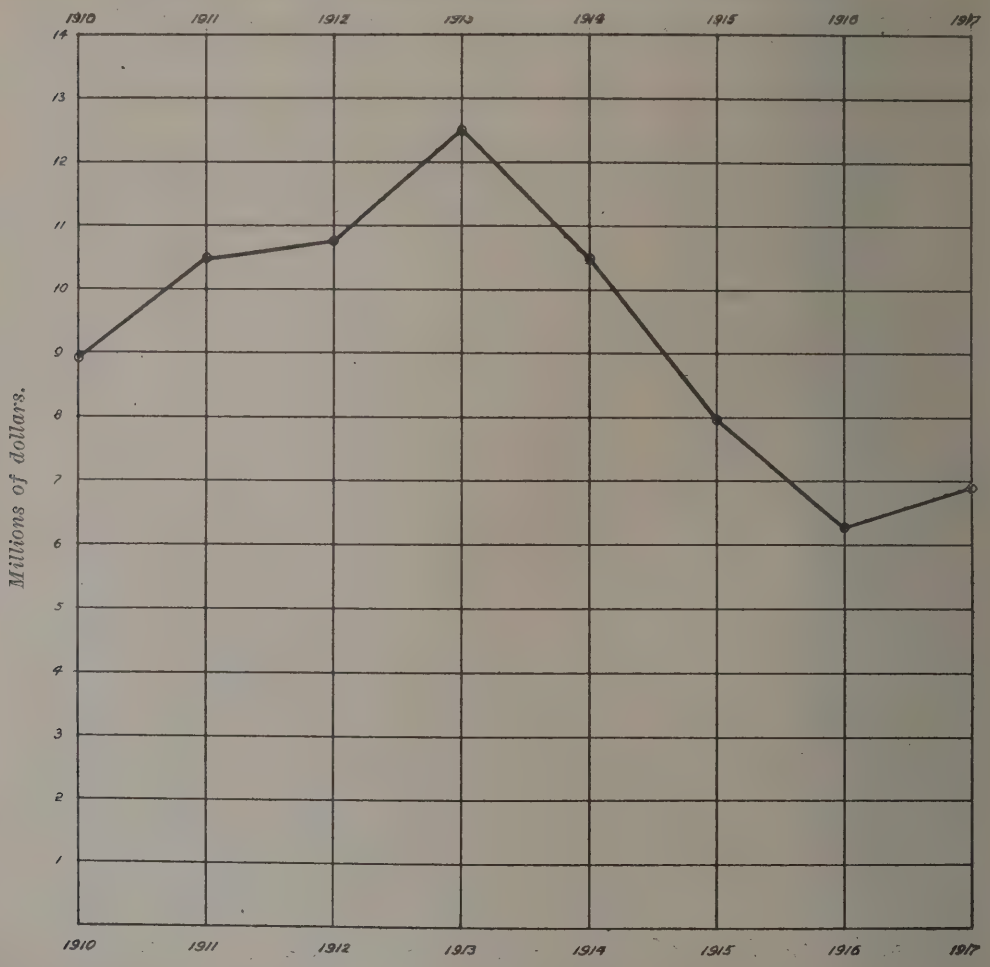
IV.—*Taxes.*									
Amusement-tax (newly imposed)	.....	.....	.....	.....	.....	.....	.....	.....	.....
"Chinese Restriction Act"	$225,000 00	$356,200 00	$1,066,000 00	$1,432,660 94	$1,723,990 60	$1,279,351 93	$251,638 83	.....	.....
Income-tax	72,053 22	190,984 16	192,924 78	240,731 63	280,302 88	348,452 03	428,708 25	$329,287 80	$296,801 75
"Motor-traffic Regulation Act"	.....	.....	.....	.....	.....	98,530 76	110,446 43	94,892 30	134,361 50
Personal-property tax	193,004 80	161,692 88	179,052 70	257,267 53	197,790 44	211,868 37	260,432 36	278,535 78	291,412 83
Poll-tax (revenue-tax)	157,821 00	260,682 00	313,338 00	381,432 00	360,663 00	3,558 00	30 00	.....	.....
Real-estate taxes—									
Improved real estate (real property, city tax)	286,226 16	335,744 26	352,372 44	298,076 26	459,570 40	501,051 11	515,143 26	492,813 64	532,106 85
Coal lands, Class A " Class B Timber lands Wild lands	101,607 29	250,904 71	316,130 83	428,274 57	546,087 20	659,424 11	646,441 93	534,459 99	521,325 26
Succession duty	31,073 08	108,495 39	200,459 88	152,243 93	193,523 90	249,275 37	162,277 60	139,907 23	277,702 73
Tax on railways (included under tax on improved real estate).									
Tax on unworked Crown-granted mineral claims	39,869 86	39,869 65	42,020 84	43,436 00	42,733 43	45,953 83	40,296 71	35,703 23	37,903 97
Totals	$1,106,655 41	$1,704,573 05	$2,662,299 47	$3,234,122 86	$3,804,661 85	$3,397,465 51	$2,415,415 37	$1,905,599 97	$2,091,614 89
V.—*Miscellaneous.*									
"Dykes Assessment Act"	.....	$ 19,080 07	$ 19,080 07	$ 19,080 07	$ 19,080 07	$ 19,080 07	$ 19,080 07	$ 19,080 07	$ 19,080 07
Hospital for Insane	$ 14,159 53	24,064 67	26,274 07	32,004 09	35,541 08	42,875 65	39,428 55	32,740 00	42,124 07
Interest	18,896 69	157,493 13	248,772 40	329,220 00	276,522 56	91,967 47	190,172 12	159,680 54	78,620 07
Printing Office	21,679 29	65,194 44	127,776 49	115,111 43	87,162 70	54,916 87	41,243 22	25,090 85	39,695 36
Provincial Home	188 27	3,895 83	308 30	5,532 62	4,101 87	2,628 81	4,846 60	4,900 27	584 80
Registered taxes	148 69	204 72	38 91	203 91	47 20	46 36	32 95	8 62	.....
Reimbursement for keep of prisoners	2,186 55	1,286 20	793 45	1,449 66	3,017 16	15,542 30	15,317 50	13,470 50	11,338 95
Revenue service refunds	1,322 87	1,735 25	1,463 32	3,564 74	2,366 70	3,184 93	977 19	563 31	632 62
Sales of Government property	1,542 93	2,058 57	7,820 82	3,439 20	4,892 89	5,741 42	4,682 14	2,254 10	4,156 54
Miscellaneous	28,706 33	45,632 70	62,751 48	90,735 38	290,457 71	155,404 66	95,588 43	98,161 37	136,826 69
Totals	$88,831 15	$320,645 58	$495,079 31	$600,341 10	$723,189 94	$391,748 54	$411,368 77	$355,949 63	$333,059 17
	$2,874,554 76	$8,818,596 28	$10,430,968 42	$10,677,762 71	$12,436,027 72	$10,398,381 10	$7,871,375 10	$6,193,560 00	$6,802,774 71
Interest on investment of sinking funds	45,906 95	56,145 66	61,923 85	67,946 11	74,187 36	80,877 64	103,121 36	98,133 00	104,008 92
Grand total net revenue	$2,920,461 71	$8,874,741 94	$10,492,892 27	$10,745,708 82	$12,510,215 08	$10,479,258 74	$7,974,496 46	$6,291,693 60	$6,906,783 63

A glance at the totals, as illustrated by Graph I., reveals at once an alarming shrinkage in the revenues of the Province. The total net revenue for the past fiscal year (ending March 31st, 1917) is shown to be materially less than it was seven years ago (1909-10, $6,906,783.63 as compared with $8,874,741.94), and scarcely more than one-half as great as four years ago (1912-13, $12,510,215.08). In this situation alone there would seem to be sufficient occasion for concern without considering the added difficulties due to increased demands upon the Treasury.

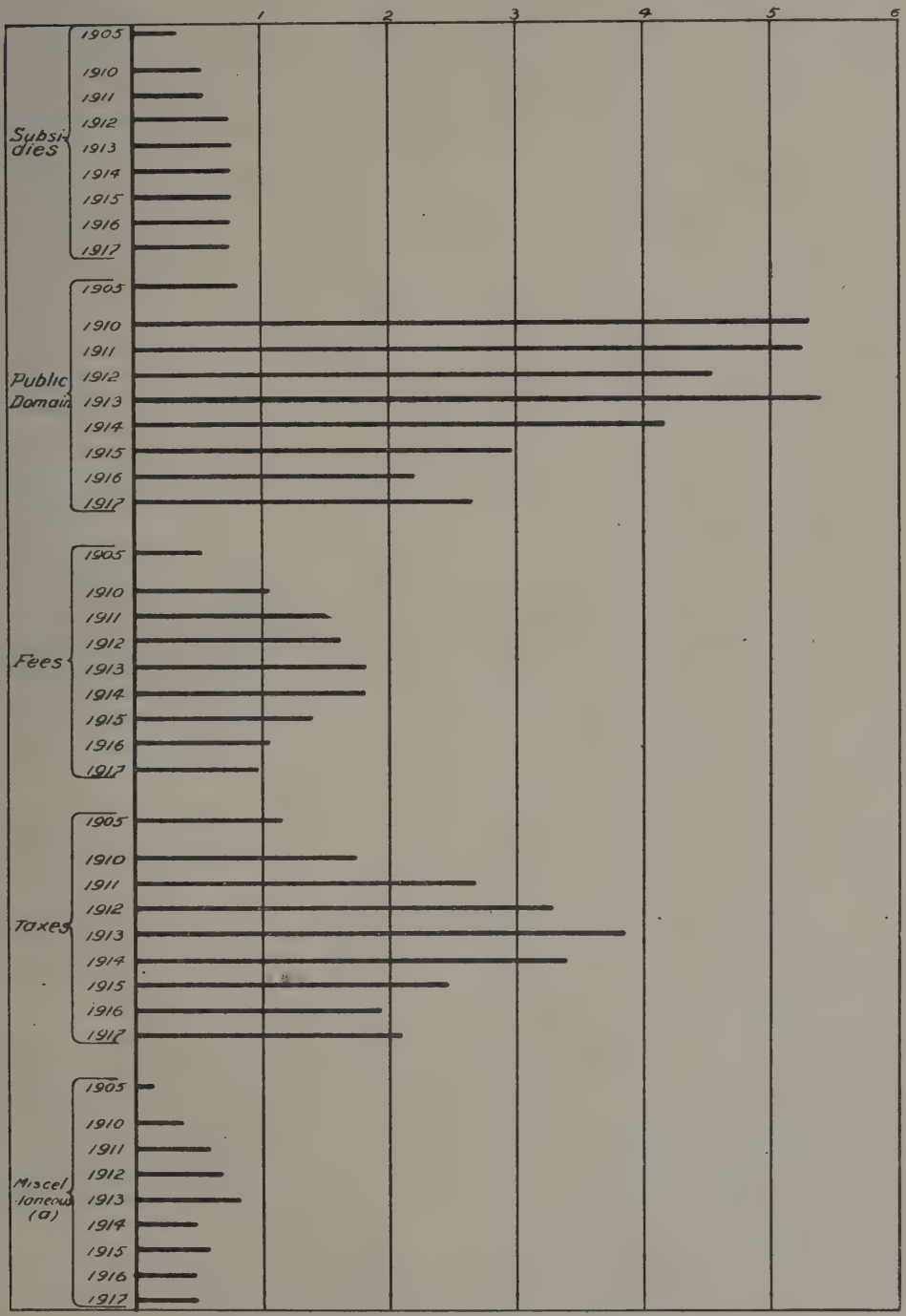
To show the variations in the different classes of revenues, Graph II. is presented, the length of the bars indicating the amounts received in the years indicated from each group of sources. Subsidies, it will be noted, have for six years been practically a constant amount. The income from the public domain, which averaged about $5,000,000 annually from 1910 to 1914, has dropped in the last three years to an average of only half that figure. Fees now yield only about $1,000,000, whereas they formerly brought in $750,000 additional. Taxes also have shrunk to nearly one-half their former productiveness, while there has been a substantial decrease in the miscellaneous revenues as well. The loss of revenue is evidently not due to some cause affecting merely one group of revenues. Every group has been adversely affected.

This same point as well as another one of interest is brought out clearly in Graph III., which compares the burden borne by the various groups of revenues in the years 1905, 1913, and 1917. In 1905, which is selected as a typical year before the great expansion of the last

Graph I.—Total Net Revenue, Province of British Columbia, 1910-17.



Graph II.—Receipts from Classified Sources, Province of British Columbia, 1905, 1910-17.
Millions of dollars.



(a) Includes interest on investment of sinking fund.

Graph III.—Portion of Total Receipts supplied by the Various Classes of Revenues, Province of British Columbia, 1905, 1913, and 1917.

decade, less dependence was placed upon the receipts from the public domain than was the case in 1913, the year of the largest receipts, and 1917, the most recent year. Taxes and fees were relatively more important in the scheme of finance. Practically no change, however, is apparent in the proportions between 1913 and 1917, except an increase in importance of subsidies in 1917, which, as has been seen, was due not to the fact that they increased, but to the fact that they remained constant, while the yields from other sources declined. The percentages are shown in Table II.

Table II.—Percentages of Total Receipts supplied by the Various Classes of Revenues, Province of British Columbia, 1905, 1913, and 1917.

	1905.	1913.	1917.
Subsidies	10.5	5.9	10 5
Public Domain	28.7	43.1	38.8
Fees	18.3	14.2	14.2
Taxes	37.8	30.4	30.3
Miscellaneous *	4.7	6.4	6.2
	100.0	100.0	100.0

* Includes interest on investment of sinking fund.

The portion of the financial burden of the Province borne by subsidies emphasizes in very striking fashion the great differences between the financial problem of British Columbia and those of the other Western Canadian Provinces. For where, as in this Province, the receipts from subsidies are sufficient to carry, on the basis of the 1917 figures, only 10½ per cent. of the burden, in Alberta they carried, in 1916, 28 per cent.;* In Saskatchewan, in 1916, 41 per cent.; and in Manitoba, 1915, 42 per cent.*

Although it has been shown that the slump in revenue is not confined to any one of the groups of receipts but is common to all, except subsidies, it can be plainly demonstrated that there is an identical cause for the slump in at least two of the groups,—fees and receipts from the public domain. That cause is the cessation in the demand for real estate. The first part of the proof of this assertion is supplied in Graph IV. It will be seen that the diminution of receipts from land sales almost to the vanishing point accounts for practically all of the reduction in the receipts from the public domain. Graph V deals with fees. It shows that in the most prosperous years "land revenue" and "registry fees,"† which owe their productiveness to the activity of the real estate market, made up the bulk of the total receipts from fees and that the decrease in these receipts is almost entirely due to the falling of these two types of fee.

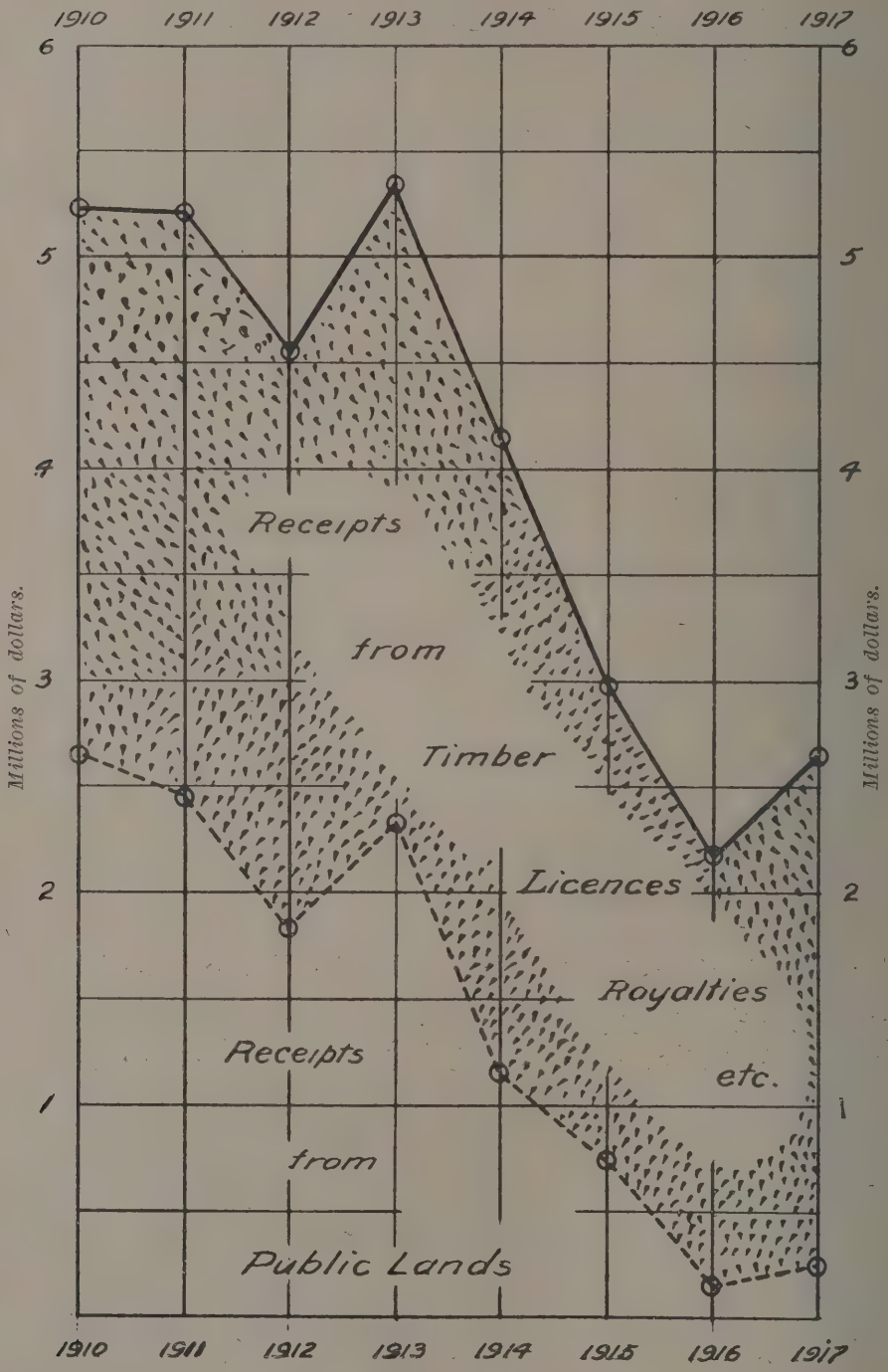
* This disregards the receipts from the Telephone Department.

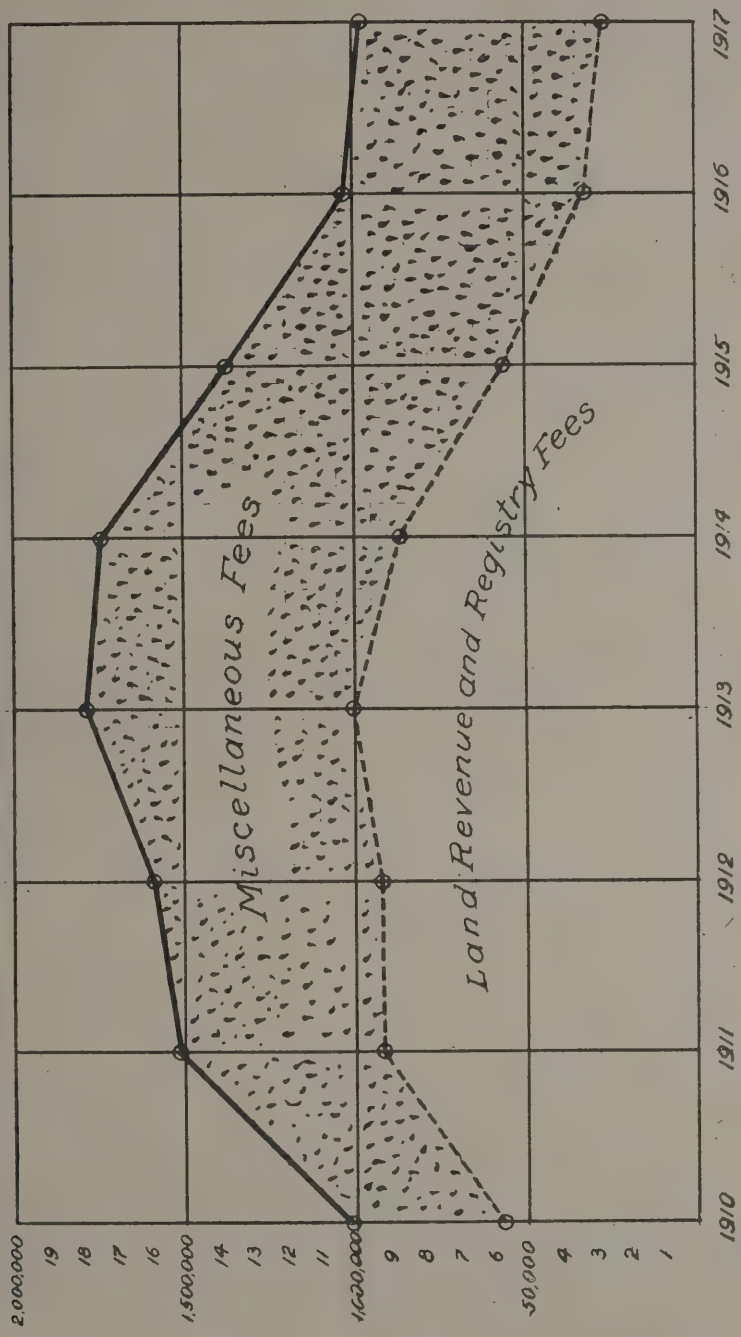
† The land revenue and registry fees are combined in the following table:—

Receipts from Land Revenue and Registry Fees, Province of British Columbia, 1910-17.

Year.	Land Revenue.	Registry Fees.	Total.
1909-10	$175,778 11	$108,826 15	$ 584,604 26
1910-11	321,586 98	613,092 22	934,679 20
1911-12	323,895 21	592,398 73	916,293 94
1912-13	301,184 95	712,258 43	1,013,443 38
1913-14	218,525 92	652,431 48	870,957 40
1914-15	127,469 53	443,727 67	571,197 20
1915-16	81,117 53	241,548 50	322,666 03
1916-17	79,919 19	196,663 90	276,583 09

Graph IV.—Receipts from the Public Domain, Province of British Columbia, 1910-17.





Graph V.—Receipts from Fees, Province of British Columbia, 1910-17.

In the case of taxes the explanation of the slump is quite different, as is shown by Graph VI. Here the decrease in productivity is entirely due to the abandonment of two forms of taxation—the tax imposed under the "Chinese Restriction Act" and the revenue or poll tax. These taxes yielded more than half the tax revenue in 1913, but disappeared entirely after 1915.

It is seen, then, that the explanation of the drop in revenue of about $5,500,000 in four years is roughly this: Due to the cessation of the activity in real estate the receipts from land-sales dropped nearly $2,500,000, and the receipts from fees connected with land transfers dropped $750,000. The bulk of the decrease is therefore chargeable to those forces which have demoralized the demand for real estate in British Columbia during the past few years. Almost all of the remainder of the decrease, about $2,000,000, was due to the disappearance of the Chinese tax and the poll-tax.

The shortage of revenue is accordingly not chargeable to a break-down of the tax system. Whatever may be said of the success or failure of the administration judged by absolute standards, it cannot be asserted that present difficulties are caused by a deterioration in that administration. Whether the taxes have produced as much as they should is a question still to be considered. It is not because they produced less than usual that the present difficult situation has developed.

The causes of the cessation in the demand for Provincial lands and for real estate generally are not entirely clear. Certainly one of them was the outbreak of the war, but the exact importance of this cause would be difficult to determine. To the extent that the war has had the effect of deadening real-estate activity, the financial problem of the Province can be truly said to be a war problem.

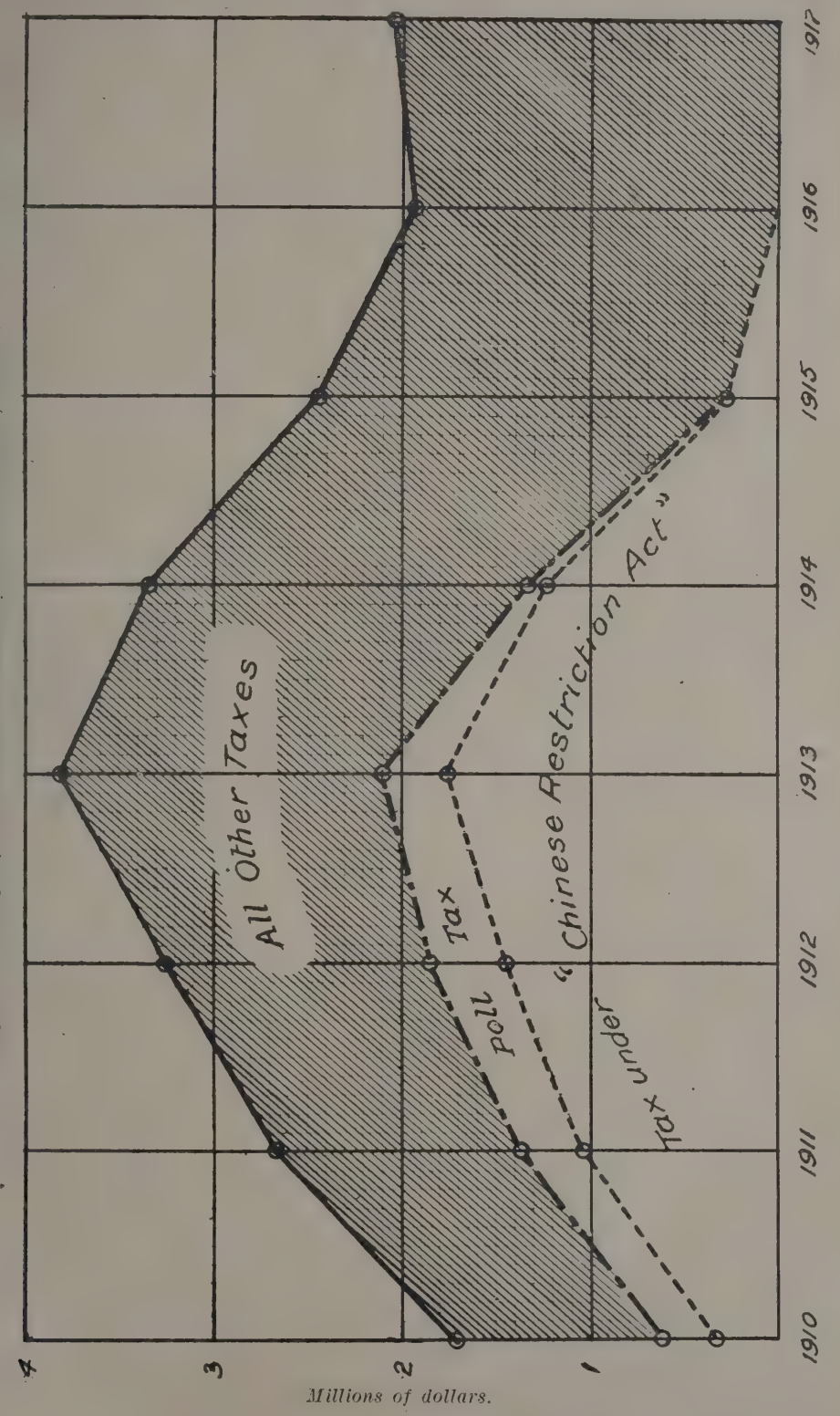
The experience of the past four years has demonstrated the lack of stability of the revenues of the Province. They have shown themselves to be excessively variable and undependable, and this constitutes the explanation of a very large part of the present difficulty. The situation in general is one which imperatively demands the adoption of one of two policies. Either the revenue system must be accepted for what it is and the policy of expenditure framed in such a fashion as to accommodate itself to the variations in receipts, or the revenue system must be radically recast with the purpose of making it productive of a more uniform series of revenues. The latter plan would be very difficult to establish completely, because of the dominating importance of receipts from land-sales in the scheme of revenues. But the desirability of a more uniform yield should be kept prominently in mind in considering changes in the tax laws. The most satisfactory solution of the difficulty lies in the direction of a more intelligent control of expenditure than has been shown in the past.

THE CONTROL OF EXPENDITURES.

This is not the place to write a financial history of the Province, though such a study would undoubtedly yield conclusions which would be valuable in connection with the proper formulation of future financial policies. It is evident, however, from a cursory survey that the scale of expenditure of the Province has been entirely out of proportion to the size and dependability of the revenues. In the years when revenues were plentiful the spending proceeded with a blissful confidence that conditions would always be satisfactory. Equipment and governmental services have been supplied with a lavishness which has entirely consumed the very unusual revenues of the prosperous years, and which has, in addition, strained to the limit the credit of the Province. Not only was money borrowed in large amounts, the net debt at the time of the 1917 Budget speech being reported as $19,777,909, but, in addition, the public credit was pledged to guarantee bonds of several railways in even larger amounts, the Province being subject to a contingent liability, in the case of the Canadian Northern alone, of no less than $47,975,000.* The transportation projects have all proved to be unsuccessful ventures from the financial view-point. As a result the Province has already been called upon to assume obligations of embarrassing size, and, unless the Canadian Northern problem is satisfactorily adjusted, it will be asked to carry a burden which will indeed be staggering.

The Estimates for 1917-18 called for an expenditure of $10,800,804.67. Of this amount, almost one-fifth ($1,985,520.67) consisted of charges connected with the public debt and about

* The securities actually executed which the Province has guaranteed for it amount to about $8,000,000 less than this figure. The total guarantees for all purposes authorized amounted on March 31st, 1916, to $73,782,072 (Public Accounts, 1916, page 27).



Graph VI.—Receipts from Taxation, Province of British Columbia, 1910-17.

one-tenth ($930,200) of expenditures connected with the guarantee of railway bonds. It will be recalled that the net revenue for 1916-17 amounted to less than seven millions ($6,906,783.63). With the loan market so unfavourable as to make borrowings almost out of the question, it will be realized that if additional taxation were to be avoided the controllable expenditures would have to be cut almost in two.

After a certain point, however, reductions in expenditure in a Province like British Columbia are difficult. Much rough and thinly settled territory lies within its borders where no local governments have been established, and in such districts the Province must provide machinery for performing all the functions of government. The expenses of this nature are often almost as great for a very sparsely settled region as they would be were the district well inhabited. Communication must be established and maintained between widely scattered settlements over difficult terrain. The policy of granting very liberal subsidies to local schools even within regularly organized municipalities has long been in operation, and radical reductions in this direction are not easy to accomplish or desirable as a matter of policy. Most of the readily effected economies had already been taken advantage of in the course of reducing net expenditure from $15,762,912.48 in 1913-14 to $9,079,317.70 in 1916-17.

Apparently the days of free and easy financing are past and may not be expected to reappear for some time to come. Unless some unforeseen event should suddenly restore the demand for real estate, the people of British Columbia must face painful economy and burdensome taxation. In any case the desirability of the strictest economy is beyond question. The more the people are willing to economize the less painful need the taxation be.

THE READJUSTMENT OF 1917.

Faced with the necessity of providing for the rather alarming discrepancy between estimated expenditures and the revenues which might be expected to accrue for the year ending March 31st, 1918, the Government at the 1917 session of the Legislature formulated a financial programme calling for a radical expansion in taxation. As will be seen by examining Table III., the changes made were expected to increase the receipts from taxes from approximately $2,000,000 to nearly $5,000,000.

Table III.—A Comparison of the 1916-17 Receipts from Taxation and the 1917-18 Estimates.

Taxation.	1916-17 Receipts.	1917-18 Estimates.
Succession duty	$277,702 73	$400,000 00
Poll-tax (revenue-tax)	.....	150,000 00
Taxes on real estate—		
Improved real estate	532,106 85	1,330,000 00
Wild lands, Coal lands, Class A, Coal lands, Class B, Timber lands	521,325 26	915,000 00
Personal-property tax	291,412 83	700,000 00
Income-tax	296,801 75	1,090,000 00
Tax on railways	.....	.....
Unworked Crown-granted mineral claims	37,903 97	50,000 00
"Chinese Restriction Act"	.....	.....
"Motor-traffic Regulation Act"	134,361 50	120,000 00
Amusement-tax	.....	100,000 00
Totals	$2,091,614 89	$4,855,000 00

This was to be accomplished, in the main, through the reintroduction of the poll-tax, the establishment of an amusement-tax, by sharp increases in the rates on property and income, by making subject to the tax certain incomes before exempt, and by an attempt to collect outstanding arrears. Because the 1917 tax rolls were already completed, the increases were made to apply as surtaxes, in addition to the normal rates, for 1917. For the following years the rates were raised to a level equal, in almost all cases,* to the sum of the 1917 normal and surtax rates.

* An exception is the case of the highest income-tax rates.

The changes made in the tax system have provoked much criticism and dissatisfaction. It must be remembered, however, that under the conditions time was not available to the Government to work out a carefully balanced tax programme which would consider with a high degree of nicety both the financial needs of the Province and the tax-paying ability of the various economic interests affected. Such a programme can be constructed only after thorough investigation.

As has been noted, the dimensions of the financial demands of the coming year are uncertain. The results of the 1917 changes in the tax system have not yet become fully apparent. There is apparently but slight ground for the hope of a decrease in the Budget, for any economies which may be effected are likely to be overbalanced by new demands. On July 1st, 1918, a direct liability amounting to $647,072 will accrue because of the guaranteed bonds of the Nakusp & Slocan Railway which must be financed in some fashion. Temporary financing by the banks has been resorted to freely, and it may be necessary to make more formal provision for the $3,550,000 which now stands in this form ($2,000,000 overdraft and $1,550,000 Treasury bills).

Perhaps enough has been said concerning the financial situation in British Columbia at the present time to show why it is difficult to forecast accurately the probable demands upon the tax system. Certainly the situation, viewed optimistically, is not a reassuring one, while, if the Province is not relieved of the menace of the Canadian Northern guarantee, and the tax system, after having been called upon to furnish $5,000,000 in place of $2,000,000, is then required to furnish $10,000,000 or $11,000,000 in place of the present $5,000,000, the situation will be a very desperate one.

A CRITICAL SURVEY OF EXISTING TAXES.

INTRODUCTORY.

The division of taxing power between the central and the local governments in British Columbia is somewhat unusual and peculiar. The situation is unlike that in the Prairie Provinces of Canada, where the cities and towns are, as a rule, given the exclusive right to tax directly all real and personal property, and the Provincial Treasury is supported almost entirely by indirect taxes, subsidies, etc. It is also unlike the arrangement in most of the States of the Union, where the State Treasuries are supplied largely by rates levied upon the same assessment base as is utilized by the municipalities. In British Columbia the distribution is much more complicated and involved. Direct taxation, far from being abandoned entirely to the localities, is made a prominent factor in Provincial finance.* But in part of the Province the Provincial authorities tax directly certain property—i.e., real estate—which in other sections it consigns it to the municipalities for taxation. On certain other types of property—i.e., personal property and income—the Provincial authorities levy taxes throughout the Province irrespective of municipal lines. This complication is due primarily to the fact that a large portion of the Province is too thinly settled to justify the establishment of local government, and in such territory the Province taxes real estate and business, whereas it has surrendered these sources of revenue entirely where local governments have been organized. The municipalities, urban and rural, supply themselves mainly by taxes on these subjects, but, in addition, are assisted by liberal subsidies from the Provincial Treasury.

These facts are not apparent in the accounts of the Province. Receipts from taxes on real estate do not appear as arising from the unorganized territory only, and receipts from taxes on personal property and income, on the other hand, are not shown as the revenue from a Province-wide tax. All of these receipts go into a general fund, and no attempt is made to meet particular expenses—those of unorganized districts, for example—out of the receipts from particular taxes.

The main structure of the Provincial tax system is set forth in "An Act to assess, levy, and collect Taxes on Property and Income."† This Act provides for the imposition of general taxes at specified rates on real estate (lying outside of municipalities, as explained above), on personal property, and on incomes. But it also provides that "the following property shall be assessed and taxed *specifically* pursuant to the several parts of this Act governing the subject:—‡

(*a.*) Canneries:

(*b.*) Coal and coke:

(*c.*) Certain corporations:

* *Cf.* supra, p. 87.
† R.S.B.C. 1911, as amended from time to time.
‡ "Taxation Act," section 7.

(*d.*) Mines and minerals other than coal and coke:
(*e.*) Mining property held by Crown grant and not worked:
(*f.*) Railways and railway subsidy lands.

These *specific* taxes operate in some cases to relieve the property from the general taxes. In other cases they do not.* The charges imposed on canneries, coal, and minerals are based on output, and partake more nearly of the nature of royalties than taxes, and are so grouped in the classification given above.† The special charges on timber (licences, royalties, etc.) are provided for by separate legislation. Finally, there are Provincial taxes on inheritances, on amusements, on motor-vehicles, and on polls.

In addition to the taxes imposed for the benefit of the Provincial Treasury, there are local school taxes administered by the Province whose proceeds go to the localities in the extra-municipal territory.

The form in which the Public Accounts are presented makes it difficult to present a detailed statement of the yield of the various taxes, but in Table IV. the available data for 1917 are arranged so as to present as clearly as possible the relative importance of the various taxes as indicated by the returns for that year. It will be noted that in the cases of three of the "specific taxes" (the tax on canneries, on certain corporations, and on railroads) the receipts are not separately stated, but are merged with the receipts from the "general" taxes. Defined thus, general taxes yield roughly one-third of the tax revenue. Another third is supplied by the charges on timber alone (licences and royalties). The miscellaneous specific taxes (excluding all of the royalties) yield less than $500,000.

Table IV.—Detailed Statement of Receipts from Taxation in the Year ending March 31st, 1917.

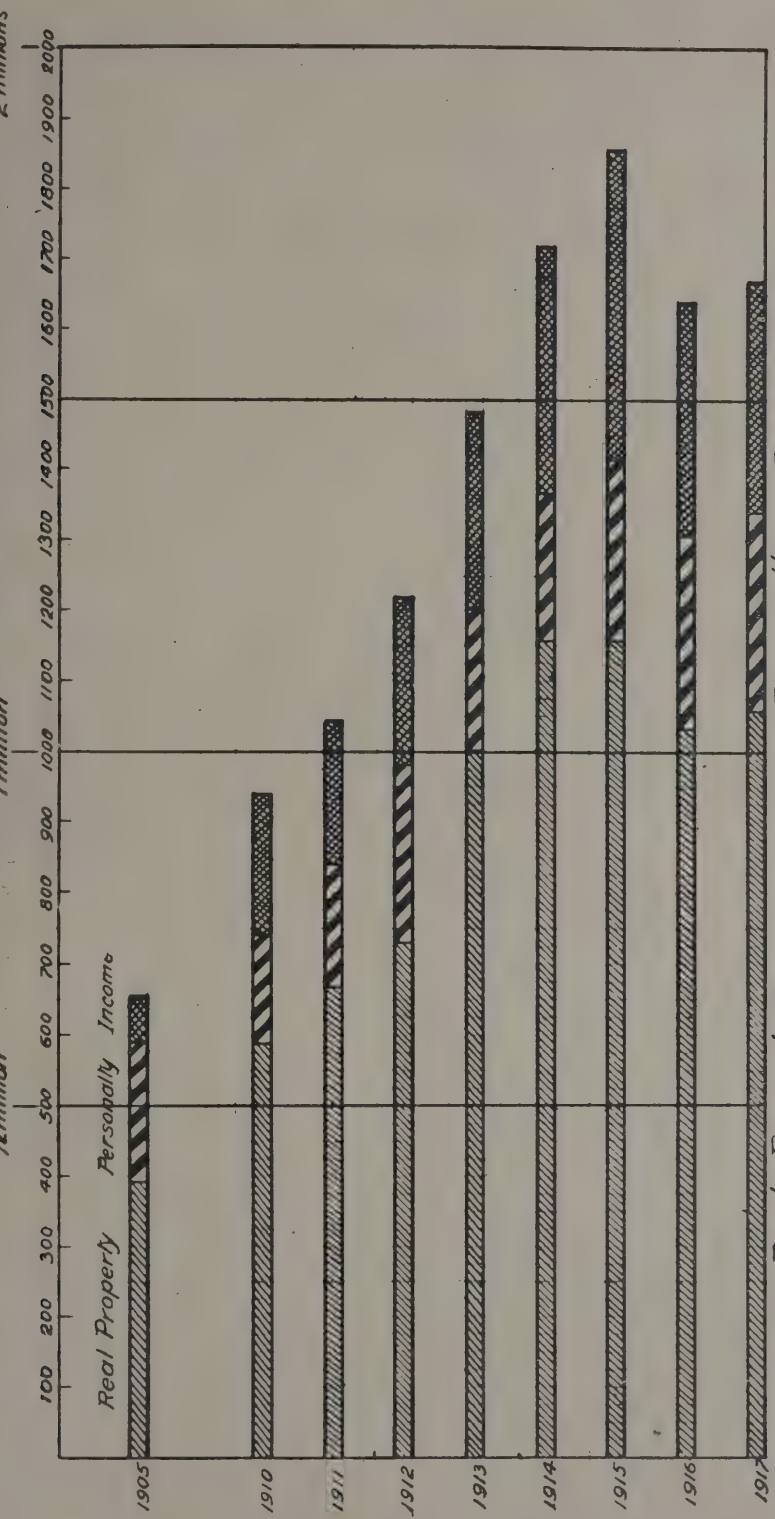
(Including Receipts from certain Taxes Levied on the Royalty Basis.)

General taxes—‡		
Real estate	$1,053,432 11	
Personal property	291,412 83	
Income	296,801 75	
		$1,641,646 69
Specific taxes—		
Levied on the royalty basis—		
Canneries (included under general taxes).§		
Coal and coke	$ 194,536 62	
Mineral-tax	287,257 59	
Timber licences and royalties	1,759,469 16	
		2,241,263 37
Other taxes—		
Unworked Crown-granted mineral claims	$ 37,903 97	
Inheritance-tax (succession duty)	277,702 73	
Poll-tax	None.	
Motor-vehicle tax	134,361 50	
Amusement-tax	None.	
		449,968 20
Total		$4,332,878 26

GENERAL TAXES.

The receipts from general taxes‖ for a period of years are given in Table V., which forms the basis for Graph VII. There has been a moderate shrinkage from 1915 to 1917 amounting to slightly more than $200,000, the decrease being divided almost equally between real property and income. The increase in personal property must be interpreted in the light of the alternative

* *Cf. infra,* pages 109-10.
† *Cf. supra,* page 82.
‡ Included among the receipts from general taxes are the receipts from the following specific taxes: Tax on canneries (included under personal property), tax on railways (included under improved real estate), and taxes on certain corporations (included presumably under income).
§ The gross levy on canneries and whaleries was $40,762.64.
‖ The figures include, as explained above, the taxes on canneries, railroads, and certain corporations.



Graph VII.—Receipts from General Taxes, 1905 and 1910-17.

arrangement under which personal property is assessed instead of income in cases where the tax levied on that base exceeds the tax levied on the base of income.*

Table V.—Receipts from General Taxes, 1905 and 1910-17.

Year ending.	Real Property.	Personal Property.	Income.	Total.
June 30th, 1905	$ 387,833 45	$193,004 80	$ 72,053 22	$ 652,891 77
March 31st, 1910	586,648 97	161,692 88	190,984 16	939,326 01
" 31st, 1911	668,503 27	179,052 70	192,924 78	1,040,480 75
" 31st, 1912	726,350 83	257,267 53	240,731 63	1,224,349 99
" 31st, 1913	1,005,657 60	197,790 44	280,302 88	1,483,750 92
" 31st, 1914	1,160,475 22	211,868 37	348,452 03	1,720,795 62
" 31st, 1915	1,161,585 19	260,432 36	428,708 25	1,850,725 80
" 31st, 1916	1,027,273 63	278,535 78	329,287 80	1,635,097 21
" 31st, 1917	1,053,432 11	291,412 83	296,801 75	1,641,646 69

TAXES ON REAL ESTATE.

The taxes on real estate are of four distinct types, as follows:—

(1.) Taxes on improved real estate;
(2.) Taxes on wild lands;
(3.) Taxes on coal lands; and
(4.) Taxes on timber lands.

In the accounts the receipts from the last three of these taxes are not differentiated. In Table XX. the yield of the wild, coal, and timber land taxes are contrasted with the yield of the tax on improved real estate for a period of years. It will be seen that before 1912 the tax on improved real estate regularly yielded larger sums annually than the taxes on wild, coal, and timber lands. For a five-year period beginning 1912 the situation was reversed, the receipts from improved real estate falling below the receipts from the other real-estate taxes. Finally, in 1917, improved real estate once more proved more productive than the other taxes.

The details which are lacking in the accounts of actual receipts can be made good to some extent by the more complete statistics of tax levies. The levies, however, do not form so accurate a basis for drawing conclusions as to the relative financial importance of the various types of taxes as do the cash receipts, because of the very large and widely varying amounts of uncollected taxes.† Table VI. gives the levies for 1916 in detail. The tax burden on wild lands is seen to have been about 50 per cent. larger in that year than the burden on improved land, in spite of the fact that the actual collections, as shown for approximately the same period in Table VII., were somewhat smaller. The taxes on timber and coal lands are relatively significant in amount.

Table VI.—Tax Levies upon the Various Types of Real Estate, 1916.‡

Improved real estate		$ 686,688 31
Wild lands		1,026,803 73
Coal lands—		
Class A	$20,093 27	
Class B	36,400 24	
		56,493 51
Timber lands		179,528 55
Total		$1,949,514 10

* *Cf. infra*, page 100.
† *Cf. infra*, pages 121-2.
‡ Tax year 1916, which coincides with calendar year.

Table VII.—Receipts from the Various Taxes on Real Property, 1905 and 1910-17.

Year ending.	Improved Real Estate.	Wild Lands.	Coal Lands.	Timber Lands.	Total.
June 30th, 1905	$286,226 16		$101,607 29		$ 387,833 45
March 31st, 1910	335,744 26		250,904 71		586,648 97
" 31st, 1911	352,372 44		316,130 83		668,503 27
" 31st, 1912	298,076 26		428,274 57		726,350 83
" 31st, 1913	459,570 40		546,087 20		1,005,657 60
" 31st, 1914	501,051 11		659,424 11		1,160,475 22
" 31st, 1915	515,143 26		646,441 93		1,161,585 19
" 31st, 1916	492,813 64		534,459 99		1,027,273 63
" 31st, 1917	532,106 85		521,325 26		1,053,432 11

Improved Real Estate.—The tax on improved real estate, appearing as the "real-property" tax in the Statute and in the accounts, consists of a 1-per-cent. rate imposed upon the full value of improved lands and permanent improvements* lying outside the limits of municipalities. The rate previous to 1917 was ½ of 1 per cent. The fullness of the assessment and the success of the collection of this tax are dealt with later in this report.†

The recent increase in the rates has caused much dissatisfaction, as is shown by the tone of the testimony offered before the Board. As a matter of fact, however, the rate of 1 per cent. is not inordinately high as compared with rates elsewhere where similar services are rendered. Indeed, when the practical immunity of the owner of improved land from personal-property taxes is taken into account, the lot of the British Columbia farmer cannot truly be said to be a hard one from the point of view of taxation. It is probably significant that some of the testimony clearly showed that it was not the absolute weight of the present burden which the farmers objected to so much as the inferred disposition on the part of the Government to consider improved real estate a likely subject for still heavier taxation.‡

The suggestions that farm lands be taxed on a basis which recognizes net yield as the controlling factor, and which discriminates even more than at present in favour of the operated farm equipped with reasonable improvements, are interesting and important. Any step in this direction should be preceded, however, by careful investigation which would attempt to reveal what could be rationally expected from the change in the directions both of encouragement to agriculture and of effects upon the finances of the Province. The present arrangement in regard to the taxation of real estate appeals to the investigator as not being so seriously unjust and oppressive as to demand hasty alterations at once without an opportunity for preliminary study and analysis.

Wild Lands.—It is a policy of long standing in British Columbia to levy a discriminating, penalizing tax on "wild" lands as opposed to improved lands. The primary purpose of the tax is to discourage the speculator from holding lands out of use. At the present time, as has been noted,§ this tax is as important fiscally as the tax on improved real estate. The rates since the changes in 1917 have been 5 per cent., an increase of 1 per cent. as compared with the previous level. This means taxation five times as heavy upon "wild" land as upon improved real estate.

It has been suggested that the classification which is made to determine what land is "wild" is undesirably crude. The law provides the Assessor shall consider "wild" "all land, other than coal and timber land, . . . on which there shall not be existing improvements to the value . . . of $2.50 per acre in the case of land lying west of the Cascade Mountains, and $1.25 per acre in the case of land lying east."‖ Much land is subjected to the 5-per-cent. rate which should not or cannot be put to use under present conditions. Moreover, the requirements of a modicum of expenditure for improvement sometimes leads to injudicious investment of capital, not with the primary purpose of developing the land, but with the intent merely to qualify under the

* The policy of exempting improvements, wholly or in part, is restricted in its application to the municipalities.
† *Cf. infra*, pages 118-19.
‡ *Cf.* Testimony, page 180.
§ *Cf. supra*, page 96.
‖ "Taxation Act," section 2.

Act as "improved" land. It is recommended that careful consideration be given to the probable effects of refining the classification* by drawing a distinction between "wild" lands which are timber, arable, or agricultural in their nature and of determining the application of the penalty rates on the basis of actual use or disuse and the social desirability of such disuse.

This suggestion assumes the desirability of continuing a distinction between wild and improved lands. There is present a considerable sentiment, on the part of the owners of wild land in particular, in favour of abandoning or materially modifying the discrimination. The question, of course, must not be settled on the basis of the desires of this group alone. But there exist reasons for modification which appear valid from the point of view of the general interests of the Province. Indeed, the tax exhibits unmistakable symptoms of something being seriously amiss. Only about one-third of the current year's levy was collected in 1916, and the total accumulated arrears now amount to more than twice the current year's levy.† This record is very poor compared with that made by the owners of improved realty. To increase taxes on wild land still further in the face of this record, as was done in 1917, involved a confidence in the willingness of the owners of wild land to continue to pay which can scarcely be justified on the basis of the facts. The very existence of a tax of this type implies the presence of other motives than the fiscal motive, however. The Province practically announces that land may not be held out of use without payment of a heavy charge, and that if a person cannot afford to pay that charge he must surrender his land. But the charge can be made so high that it will not be economically wise for the individual to continue to pay the taxes which he must pay if his title is to be kept clear. Evidently that is what has occurred in many cases in British Columbia already. The present rates are apparently resulting in wholesale confiscation. But, if any significance is to be attached to the settlement permitted under the "Soldiers' Homestead Act" this confiscation is not desired by the people of the Province.

It is perhaps clear that there is some degree of antagonism between the two aims of this tax—viz., the fiscal aim and the social aim. To be a good revenue-producer, rates should be moderate. To be a good engine of social reform, the rates should be high. The problem is to strike the particular compromise which will best meet the desires of the Province. In this case one cannot eat his cake and have it too.

Coal Lands.—Coal lands are placed in a separate category for purposes of taxation. They are defined as all lands "owned, leased,‡ held under licence,‡ claimed, or occupied by any person for the special purpose of mining coal therefrom, and which is not held or used for any other purpose."§ These lands are subdivided into two classes. Lands in Class A, which include the lands which are being actively mined, pay the same tax rate as improved agricultural real estate, 1 per cent.‖ Class B lands, consisting of unworked coal lands, are taxed at a 4-per-cent. rate (until 1917, 2 per cent.).

The distinction between the active and inactive coal lands rests on the same theoretical foundation as the distinction between improved and wild land. It is, of course, directly contrary to the fundamental theory of the income-tax. In any reformulation of policy which is attempted with respect to wild lands, coal lands should be included in the consideration.

The tax on coal land is not of great fiscal importance, the total levies for years past, as set forth in Table VIII., having been in the neighbourhood of $50,000 annually. The increase in the rate on Class B land in 1917 causes a substantial increase in the levy. But, if the absence of formal complaint before the Taxation Board be of any significance, the higher rate has not caused great dissatisfaction. Certainly the burden added to the coal-mining interests is in no sense comparable to that added to metalliferous-mining interests by the legislation of 1917.

* This is in accordance with the suggestion of the Hon. John Oliver.
† *Cf. infra*, pages 121-2.
‡ The exemption stated in section 8, subsection (24), of the "Taxation Act" evidently applies here.
§ "Taxation Act," section 2.
‖ The distinction between Class A and Class B coal lands is set forth in section 9 of the "Taxation Act." Briefly, the test as to whether the land shall be considered active is the payment of the royalty on coal mined. Contiguous lands may be classified as Class A to the extent that the royalties paid will cover the tract at the rate of 25 cents for each acre.

Table VIII.—Levies on Coal Lands, 1909-17.

Year.	Class A (Active).	Class B (Inactive).	Total.
1909	$15,234 57	$ 5,459 85	$20,694 42
1910	17,367 36	5,004 11	22,371 47
1911	19,787 88	22,920 61	42,708 49
1912	20,651 85	23,651 29	44,303 14
1913	16,443 14	34,058 96	50,502 10
1914	22,696 47	33,444 13	56,140 60
1915	21,930 46	37,264 80	59,195 26
1916	20,093 27	36,400 24	56,493 51
1917	21,038 53	74,432 00	95,470 53

Timber Lands.—The policy of the Government in regard to the timber lands has varied radically from time to time. Formerly it was the practice to dispose of large tracts of forest by Crown grant, and later under leases and licences. A tax is levied on all such land* "which in the opinion of the Minister of Lands is held in sufficient areas for the purposes of forestry," provided it contains marketable timber to the average extent of 8,000 feet to the acre west of the Cascades and 5,000 feet east of that range.† Until 1917 the rates on timber land were 2 per cent. of the assessed value. They were raised in that year to 3 per cent.‡

The rate of 3 per cent. is difficult to justify on any other than the punitive, penalizing theory of the wild land and Class B coal land taxes. Heavy taxation on the capital value of timber lands is universally condemned by students of forest taxation as an undesirable type of levy. It is asserted also by the timber interests that the change has brought about a condition of substantial inequality because it involves increased taxation upon one section only of the timber industry—viz., those concerns who chance to be operating over lands procured when the earlier Provincial policies were in force.

The levies upon timber lands for a period of years are shown in Table IX. While materially larger than the levies on coal land, the tax is one of the distinctly minor sources of revenue.

Table IX.—Levies upon Timber Lands, 1909-17.

1909	$104,671 63
1910	110,789 62
1911	137,820 33
1912	150,059 19
1913	166,580 61
1914	186,671 13
1915	167,651 95
1916	179,528 55
1917	264,687 87

It is seen that the most immediate and troublesome questions connected with the taxation of real estate are concerned with the taxation of wild, coal, and timber lands. The principle of penalizing non-use appears to have been carried to the point where it seriously affects the fiscal productivity of the tax. In the light of present financial pressure the policy of the Province in connection with these taxes is worthy of serious attention. The effect of the added taxation on timber lands deserves a detailed examination which requires more time than was available in the course of this investigation.

TAXES ON PERSONAL PROPERTY.

Unlike the taxes on real estate, the personal-property tax is Province-wide in its scope, being applied both within and without municipal boundaries. While formerly it was a part of what was essentially a general property-tax system, various changes have in the course of years consigned it to a decidedly anomalous position in the tax system. First of all, exemptions have been granted with such liberality as to reduce the tax on personal property from a general tax

* The exemption stated in section 8, subsection (24), of the "Taxation Act" evidently applies here.
† "Taxation Act," section 2.
‡ *Ibid.*, section 9.

to what is in practice mainly a tax on stock-in-trade. Thus machinery is defined in the law as real estate,* and is therefore only taxable by the Province outside of the municipalities. If it were defined as personal property it would be subject to the Provincial tax within the municipalities also. Other important exemptions include money invested in mortgages on property in the Province, the securities of companies paying Provincial taxes and of municipalities, unsecured book debts, bank deposits, household furniture, farm produce, and, to the amount of $1,000, the live-stock, machinery, and vehicles on every farm.†

Formerly the income-tax was imposed in addition to the personal-property tax. But the drift away from the taxation of personal property which has been evident in British Columbia for so many years early took the form of an attempt to substitute the income-tax for the personal-property tax. The ideal and the theory of the income-tax apparently makes a strong appeal to the business-men of the Province, and, suffering by constant comparison with the income-tax, the personal-property tax has become increasingly unpopular. The Assessment Commission of 1905‡ recommended the substitution of the income-tax "for any impost on personal property." The Royal Commission on Taxation of 1911§ repeated this recommendation. It is now urged once more by the Vancouver Board of Trade.

The movement in this direction has been strengthened by the action of the Province in establishing the alternative arrangement under which a person assessable on both personalty and income pays that tax only which is largest in amount. This practically consigns the personal-property tax to the rôle of a minimum income-tax.

The excuses for the failure to abolish the personal-property tax and the persistence of the present alternative arrangement are lack of confidence in the administration of the income-tax and a desire to ensure a certain minimum of revenue. To abolish the personal-property tax would, of course, increase somewhat the variability of revenues. There is, however, some ground for the complaints of business-men that the arrangement as it now stands operates unfairly. It is recommended that the income-tax be entirely substituted for the personal-property tax, provided the administration of the income-tax is improved and the condition of the Provincial Treasury is such as to enable it to assume the risk of the somewhat decreased revenue which would probably result.‖ If the abolition of the personal-property tax alternative involves increasing income-tax rates still more, the step should not be taken at this time.

The rate which formerly obtained, ½ of 1 per cent., was so low as to impose but a relatively slight task upon the administration. Raising it to 1 per cent., as was done in 1917, increases the difficulty of securing a full assessment. But this rate is still low compared with those obtaining in the States of the Union, and with the liberal exemptions of the types of personal property most difficult to assess, the fiscal yield of the tax should not be seriously menaced by administrative difficulties.

THE INCOME-TAX.

The history of the development of taxation in the Province shows an interesting tendency toward the magnification of the income-tax. Yielding in 1905 the insignificant sum of $72,053.22, the tax has increased in fiscal importance until in 1917 it produced $296,801.75. Moreover, the readjustment in 1917 resulted in a substantial widening in application and a radical increase in the rates. If the history of income-taxes elsewhere repeats itself in this case, a progressively larger rôle is to be expected for this element in the revenue system. This, of course, adds importance to the proposal to refine the tax and to place it upon a satisfactory basis.

The income-tax in force in the Province of British Columbia is open to serious criticism from several directions. Taxable income as determined under the law bears only a remote resemblance to true net income. Because of irregularities in the progressive scale of rates and because of special provisions affecting particular groups of taxpayers, the tax is inequitable in its application. All available evidence shows the law to have been ineffectively administered even under the low rates in force in the past. The imposition of the new Federal income-tax, which

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* "Taxation Act," section 2.
† "Taxation Act," section 8.
‡ Report of February 16th, 1905, cited by Vineberg, Provincial and Local Taxation in Canada, page 45.
§ Report, pages 19, 20.
‖ The personal-property tax in 1917 produced $291,412.83. The abolition of the personal-property tax alternative would not involve the sacrifice of this total amount, however, for a considerable portion of it would be supplied by the income-tax ruled out under the alternative arrangement.

draws upon the same source, and the increase of the Provincial rates create a situation which is full of sinister possibilities for the future of this tax. Inequalities which can be ignored when rates are low become important when rates are raised to the present levels. An administrative reorganization is imperative, a redefinition of taxable income is very desirable, and a reduction in rates may be found necessary if the tax is to be made workable and successful.

THE DEFINITION OF TAXABLE INCOME.

In form the British Columbia income-tax is a tax on net income, but the number of items, essentially expenses, which may not be deducted in arriving at "taxable income" is so great that the result cannot truly be described as "net." Most of the forbidden deductions appear to be placed in the law because of the fear that they will lead to wholesale evasion. Undoubtedly the complaints are well founded that the law in its present form leads to considerable injustice. Under proper administrative conditions it should not be necessary to sacrifice equality to secure a full assessment. But to bring about these conditions there must be a reorganization of the tax machinery and a change of attitude on the part of the taxpayer toward the law. To accomplish the latter it may be necessary to reduce somewhat the present scale of rates.

The items which the taxpayers insist they should be permitted to deduct, but which under the present law they must include in their return of taxable income, are the following:—

(*a.*) Allowances for depreciation and depletion:
(*b.*) Interest on borrowed capital, irrespective of the resident or non-resident ownership of such capital:
(*c.*) Directors' fees and salaries of certain officers and managers of the corporation:
(*d.*) Taxes paid to the Federal Government:
(*e.*) Local taxes on business buildings occupied by owners:
(*f.*) Losses and bad debts, even though not written off during the year when the liability is incurred.

Allowances of Deductions for Depreciation and Depletion.—The provisions of the present law make it impossible to deduct depreciation and depletion allowances from gross income in arriving at "taxable income."* This situation does violence to business customs and good accounting practice, and is the cause of much bitter resentment, particularly among the large taxpayers. Depreciation is a very important item in many industries, and, moreover, it varies greatly from business to business. Consequently not only does the taxpayer consider himself taxed on an item of prime cost as though it were a profit, but he also, quite properly, feels himself at a disadvantage as compared with his neighbour whose capital is of a nature which depreciates less rapidly than his own. It is the prevailing practice generally where income-taxes are levied to allow reasonable deductions for depreciation, and it is strongly recommended that the law be so amended as to permit such deductions in British Columbia. Allowances for depreciation should never be permitted to exceed the amounts charged for such purposes in the accounts of the enterprise. Repairs, narrowly defined, should be deductible in addition to depreciation, but renewals and replacements are properly covered by depreciation itself.

Obsolescence is one of the elements in depreciation, but practice varies in regard to allowing it as a deduction in determining income for purposes of taxation. The Wisconsin law expressly forbids such deductions.† The United States Federal law permits them,‡ and the language of the new Dominion law is evidently sufficiently broad to allow them at the discretion of the Minister of Finance.§ In case they are allowed, the deduction should be restricted to the obsolescence which actually accrues. Obsolescence cannot be anticipated with a degree of certainty necessary to make it a proper deduction before its actual occurrence.

As would be expected where mining forms so large a part of the economic activity of the Province, there is dissatisfaction because of the fact that no deductions are permitted on account of depletion. If the income-tax is to be a tax on true net income, such allowances should certainly be made. This coincides with the prevailing practice in American income-tax laws. Depletion is specifically provided for in the new Dominion law‖ and in the Wisconsin income-tax

* Subsection (12), section 75, of the "Taxation Act" declares that no deduction shall be allowed "for depreciation, or for any expenditure of a capital nature, or for renewals or extensions."
† The Wisconsin Income-tax law, with explanatory notes (Third Edition issued by the Wisconsin Tax Commission, 1917), page 13.
‡ Montgomery: Income Tax Procedure (N.Y., 1917), page 229 *et seq.*
§ The "Income War Tax Act," section 3, subsection (1) (*a*).
‖ The "Income War Tax Act," *loc cit.*

law.* Formerly it was permitted only in part by the United States Federal law,† but recent changes make possible full deductions.

In allowing for depletion, the total deduction should never exceed the actual cost in cash of the ores and deposits. If this rule is applied, mistakes in the direction of too great or too small allowances for depletion tend to eliminate themselves. Thus, if depletion is claimed at too heavy a rate, the taxable income in later years would be increased, whereas if the rate of depletion is made too light it can be increased and the tax correspondingly lightened when this becomes apparent.

Only two points can be advanced in defence of the present practice of refusing deductions for depreciation and depletion. One is that the Province cannot afford to give up the revenue which it would lose if allowances for these purposes were permitted. The other is that it is impossible to construct a satisfactory plan for the determination of the amounts to be allowed as deductions for such purposes. In regard to the first point, it may be confidently asserted that it would be better, in the case of depreciation at least, for the Province to advance rates on the new base to a height sufficient to make up for the loss in revenues. The second point, considered in the following section, is more serious.

The Determination of the Amounts of Depreciation and Depletion.—If it be granted that deductions should be allowed for depreciation and depletion, the question arises immediately as to what machinery should be provided to administer this part of the tax law. A moment's consideration reveals the undesirability of fixing by Statute the rates of depreciation to be allowed in the various lines of business. A Statute which attempted to do this would be complex and crude to a ridiculous degree. The ordinary procedure elsewhere is to vest some administrative officer with authority to pass upon the question of the reasonableness of the claims for depreciation, sometimes with restrictions upon the size of the allowances and sometimes without. As a practical question in the Province of British Columbia, the delegation of such power to a single individual, or to a group of individuals who are in a position where political influence is a factor, would be highly undesirable. The duty of passing on such questions would carry with it a responsibility which would probably not be welcomed by the present or any future Minister of Finance. The proper exercise of this function is not a political matter. It consists of a process of arriving at a decision on the basis of ascertainable fact. It is possible, by a reasonable degree of industry on the part of officials and co-operation on the part of business-men, to arrive at results which are substantially accurate, and if the power were in the hands of a body in whose ability and disinterestedness the business-men of the Province had confidence, there is no question that the problem would be satisfactorily solved. The matter therefore resolves itself into that of establishing an administrative Board sufficiently high in calibre and sufficiently far removed from political influence to merit the confidence of the citizens of the Province.

What restrictions should be placed upon such a Board in the exercise of its function of passing upon deductions for depreciation is a question whose answer depends upon circumstances. Is it likely that pressure will be brought to bear to such an extent as to sweep the Board off its feet? Is there a fiscal necessity which, while it permits a moderate allowance for depreciation, precludes the possibility of full or liberal allowances? In general it is, of course, desirable to fetter the Board as little as possible, provided always that a Board of high quality is obtainable.

Another question to be decided is that of appeals from the decisions of such a Board. It may be wise to permit a dissatisfied taxpayer to present his case to the Supreme Court of the Province. But the inclusion of such a provision must not be expected to provide an automatic check which will prevent all abuses on the part of the Board. A taxpayer who has not been successful in securing the deductions he thinks proper may in this fashion have an opportunity to redress his grievances. But the taxpayer who, by one means or another, has secured deductions unfairly large in amount will not be prevented from profiting thereby because of the existence of this appeal to the Courts. The only way to meet this situation is by making sure that the Board is competent, independent, and upright. If such a Board cannot be secured, it were better to abandon plans for allowing deductions for depreciation, or even to abandon the income-tax in favour of some other method.

* The Wisconsin Income Tax Law, page 12.
† Montgomery, *op. cit.*, page 232 *et seq.*

Allowance of Deductions for Interest on Borrowed Money.—At the present time the law forbids the deduction of "any interest on borrowed capital from which an income is derived, if such interest is paid to a lender who is not a resident of the Province, or to a company as lenders, which company does not transact business in the Province, and which does not pay taxes thereon in the Province."*

Whether deductions should be permitted for interest paid on money borrowed from non-residents in this particular situation is a question concerning which much can be said on both sides. Fundamentally it involves the whole theory of *situs* in income taxation. It may be urged with some appearance of justice that the authority in whose jurisdiction the income is earned should have first claim upon it for purposes of taxation.† But British Columbia does not accept this particular theory of *situs* in a rigorously logical fashion, for no allowance is made for deductions in the case of citizens of British Columbia who have invested their capital abroad. From the point of view of the business, no distinction between resident and non-resident capital can be justified. As the business-man views the situation, he is permitted to borrow locally without penalty, but can borrow abroad only upon condition that he pay the Province (in some cases) 10 per cent. of the interest. This seems to him to be anything but taxation according to ability to pay. Moreover, when there is such a dearth of local capital it appears to be a direct discouragement to capital seeking investment within the Province.

However, there is a serious, practical question involved because of the manner in which many of the large undertakings in British Columbia are financed. For often the securities are so arranged that practically all of the money invested is represented by bonds, the true owners of the business appearing as creditors with their money loaned to the concern rather than as investors owning directly their equities. Under such conditions the deduction of interest charges in determining taxable income would convert the income-tax into an excess-profits tax. This would mean added variability in revenues and higher rates if the same yield was to be secured. A combination of a heavier property-tax with such an excess-profits tax offers interesting possibilities. At the present time, however, it is the opinion of the investigator that the allowance of deductions for interest on outside capital, important though it be, is not so urgent a matter as are some of the other changes, such, for example, as deductions for depreciation. If it can be afforded, it might be well to introduce it with a limitation upon the amount, somewhat after the fashion of the United States Federal income-tax law, which permits deductions for interest on indebtedness "to an amount of such indebtedness not in excess of"‡ the capital of the company and§ one-half of its interest-bearing indebtedness.‡ The Wisconsin law, which formerly restricted deductions for interest in a fashion very similar to the Federal law, has recently been changed so as to permit full deduction.§ Such limitations are open to serious criticism. There is no logical stopping-point between any allowance at all and complete deduction of interest. Moreover, limitations of this kind have an unfortunate tendency to encourage excessive capitalization. They can only be defended on practical grounds of fiscal necessity.

Allowance of Deductions for certain Fees and Salaries.—The law at present forbids deductions "for directors' fees, and for salaries of persons holding offices as directors, and for the salary paid the president, vice-president, and general manager of any company or body corporate."‖ The only excuse for such a provision is that, in its absence, the practice would prevail of distributing dividends through the device of inordinately high salaries and fees. A less crude method of preventing such practices is to vest some body with authority to pass upon the reasonableness of fees and salaries. The distinction suggested between resident and non-resident officers is one which is not easy to defend. If a permanent Tax Board is established, the control of these deductions should be made one of its functions.

Allowance of Deductions for Taxes paid to the Federal Government.—It was urged by witnesses who appeared before the Taxation Board that Federal taxes be deducted in arriving at income for the purposes of Provincial taxation. At present this is specifically forbidden.¶ This contention has a certain appearance of reasonableness, but upon close examination it proves to be a claim of very doubtful validity. The amount of net income has long been the standard

* "Taxation Act," section 76, subsection (10).
† Vineberg: Taxation in Canada, page 76.
‡ Montgomery, *op cit.*, p. 138.
§ The Wisconsin Income Tax Law (Second Edition), page 13.—Interest formerly could be deducted on indebtedness "to an amount of such indebtedness not exceeding its paid-up capital stock outstanding at the close of the year; provided that the amount of such capital stock shall in no case exceed the clear value of its assets over and above all indebtedness and liabilities.
‖ "Taxation Act," section 76, subsection (13).
¶ "Taxation Act," section 75, subsection (6).

used for determining what the contribution of the taxpayer shall be toward Provincial expenses. Recently the Federal Government has adopted this standard also for determining the amount of certain taxes levied for Dominion purposes. These taxes in some cases are very large, and to permit their deduction would substantially reduce Provincial taxes. In other words, the imposition of the Federal tax, if deduction were allowed, would automatically diminish the Provincial tax burden in every case where a Federal tax is payable. From the taxpayer's point of view he is certainly less able to pay taxes to the Province in the presence of these Federal taxes. But, on the other hand, it may be contended for the Province that the Federal burden was placed upon these taxpayers with full knowledge of the existence of the present Provincial burden and in the confidence that there exists an additional ability to pay taxes which justifies the new levy, distributed as it is. The fundamental question, of course, is whether the Provincial tax burden is apportioned more fairly among the taxpayers when Federal taxes are deducted from income than when they are included. The writer is inclined to believe that the most wise and just course in this case is to consider the Federal and Provincial income-taxes as merely two rates applying to substantially the same tax base.

Allowance of Deductions for Local Taxes on Business Buildings occupied by Owners.—Under the rulings of the Department, deduction 6 (Form 7) is so interpreted as to disallow as a deduction local taxes on a business building occupied by the owner. The clause reads: "For municipal taxes and rates paid on real property, from which an income is derived, but not otherwise."* It would seem better practice to interpret the law so as to consider a business building occupied by the owner as a piece of property "from which an income is derived." The present ruling gives the business-man who rents his premises an unfair advantage over the man who owns his place of business.

Allowance of Deductions for Bad Debts.—The present law permits deductions for "losses and bad debts arising out of the business from which an income is derived, irrecoverable and actually written off during the year, but not otherwise."† The language is somewhat indefinite, but it has been so interpreted as to refuse deduction except in cases where the losses arise out of liabilities originating in the current year. This obviously brings about a ridiculous state of affairs. If the tax is to be on net income, deductions should be permitted for all losses because of bad debts, not for merely a portion of them determined in any such fashion. Proper allowances may be made in one of two ways. The first and, on the whole, the preferable method is to allow the deduction of a contingent fund to meet bad debts. This is done under the English income law.‡ The other method is to permit deductions for all losses as they actually occur. This is the practice under the United States Federal§ law and the Wisconsin law.‖ There would be little difference in the financial yield between the two methods.¶

The redefinition of taxable income in the manner suggested in the preceding sections will bring about a more equitable and generally satisfactory income-tax. Most of the points resolve themselves practically into questions as to whether the Province can afford financially to adopt them. However, in considering the financial effects of refinements in the income-tax law, it is well always to bear in mind the possibility of the changes inspiring a fuller co-operation by taxpayers, with a consequent improvement in administration and money yield.

INCOME-TAX RATES.

Recent Changes in Rates.—Historically the income-tax in British Columbia has been elastic and variable, the rates being changed very frequently.** In 1897 incomes over $1,000 were taxed from 1¼ to 1¾ per cent. In 1901 the Legislature increased the progression, the rates being made to range from 1½ to 4 per cent., the highest rate applying to portions of incomes in excess of $40,000. Two years later, in 1903, there was a slight reduction by which the highest rate was made 3 per cent. In 1905 the rates were raised once more, the range being from 1½ to 4 per cent., the highest rate applying when the taxable income exceeded $7,000. These rates stood until 1910, when a slight reduction established the schedule which was maintained until the changes of last year.

* "Taxation Act," Form 7.
† Form No. 7, deduction No. 4.
‡ Montgomery, *op. cit.*, page 186.
§ *Ibid.*, page 184 *et seq.*
‖ The Wisconsin Income Tax Law, page 14.
¶ The adoption of the first would involve the amendment of section 76, subsection (8), of the "Taxation Act."
** *Cf.* Vineberg: Provincial and Local Taxation in Canada, page 73 *et seq.*

The Legislature in 1917, therefore, found the following income tax rates in force:—*

	Per Cent.
Class A—First $2,000 of taxable income	1
Class B—When income is more than $2,000 and not more than $3,000	1¼
Class C—When income is more than $3,000 and not more than $4,000	1½
Class D—When income is more than $4,000 and not more than $7,000	2
Class E—When income is more than $7,000	2½

This range of rates is illustrated by Graph VIII., which sets forth also the increases established for the year 1917 by the surtax legislation and the range decided upon for the year 1918 and thereafter. The radical nature of the increases becomes immediately apparent. Rates on incomes of $10,000 or more (taxable income) were doubled for 1917 and trebled for 1918. Incomes of more than $20,000 were called upon for doubled taxes in 1917 and quadrupled taxes in 1918. The highest rates, 12½ per cent. on incomes of more than $50,000 for 1917, represent taxation five times as high as existed in 1916 and more than three times as high as ever before existed in the Province.†

These radical increases in the rates would of themselves appear to invite sufficiently serious administrative difficulties, but the problem is greatly aggravated by the decision of the Federal authorities to impose a Dominion-wide income-tax with highly progressive rates. The combination of this new Federal tax with the increased Provincial tax results in a level of rates which is dangerously high from an administrative point of view. A thorough reorganization of the Provincial tax machinery is imperative if an administrative break-down is to be avoided, and there is some ground for doubt as to whether this will be sufficient to meet the situation or whether it will not be necessary also to reduce rates.

The combined effect of the Federal and Provincial income-taxes is set forth in detail in Table A and Graph A, presented in an Appendix.‡ The table§ shows the taxes payable to the Province and to the Federal Government by persons and corporations receiving incomes of varying size, and sets forth the resulting rate upon each person's total income. It will be noticed from an inspection of the graph that the combination of the two taxes results in a very sharply and irregularly progressive tax upon incomes below $40,000. On the larger incomes the progression is more gradual and regular.

It must always be borne in mind that an income-tax assessment depends to a very large degree for its success upon the co-operation of the taxpayer. Very high rates are always powerful incentives to evasion. Under the present scale of rates the single man with an income of $10,000 is asked to pay $845 or 8.45 per cent. of his total income. A $25,000 income involves a levy of $4,270 or 17.08 per cent. A $50,000 income pays $10,170 or 20.3 per cent. in taxes to the Federal and Provincial Governments, whereas last year it paid only $1,212.50 or 2.4 per cent. On the largest incomes the rates approach 39 per cent. Under these changed conditions assessment machinery which worked poorly before can scarcely be expected to prove adequate.

Purely for administrative reasons, therefore, without considering the other effects of the high rates, it is desirable to make a reduction in the present scale of rates at the earliest practicable moment. A patriotic motive is present in the case of the Federal tax which will undoubtedly be a powerful aid in the administration of that law. But the absence of this motive in the Provincial tax, together with the high level of the Federal rates, makes the Provincial problem doubly difficult. Only a test will show whether the rates are too high to be successfully maintained, but the prospect contains plentiful cause for apprehension.

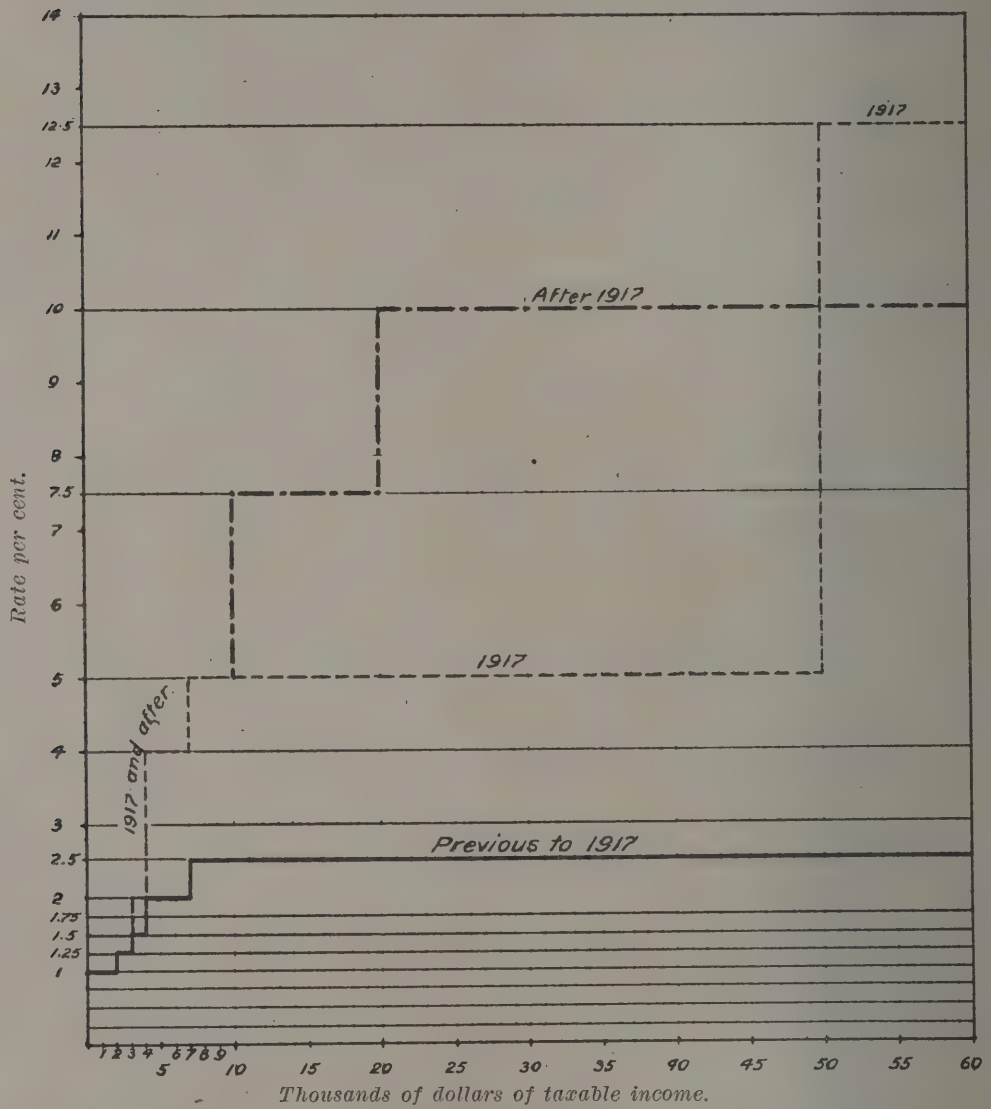
Aside from the question of difficulties involved in administering the income-tax law under the present high schedule of rates, there is the question of the burdensomeness of the rates upon the taxpayers. The testimony before the Taxation Board reveals considerable uneasiness on this score also.

The Initial Exemptions.—The present initial exemption of $1,500 is extended indiscriminately to single men, married men, and to corporations. A differentiation is usually made among these classes and might well be introduced in British Columbia at this time, particularly in view of the increased rates of the income-tax and the proposed elimination of the personal-property tax. It is suggested: (*a*) That the exemption for single persons without dependents be reduced from

* The initial exemption having been changed to $1,500.
† Assuming that the rates did not exceed 4 per cent. before 1897.
‡ *Cf. infra*, pages 129, 130.
§ This assumes that the definition of taxable income is the same under both laws.

Graph VIII.—Provincial Income-tax Rates.

(Taxable Income is the Income above the Initial Exemption of $1,500.)



$1,500 to $1,000; (*b*) that the exemption for man and wife be retained at $1,500, but (*c*) that an additional exemption of $200 be permitted for each child or other person actually supported and entirely dependent. These initial exemptions are formulated on the theory that justice demands that a certain minimum of income should be allowed to the family unit before any tax burden of this type is imposed, and it is obvious that the amount of this minimum should not be the same amount in the case of a single man without dependents as in the case of a married man with a large number of children. Finally, it is believed (*d*) that the initial exemption now extended to corporations could well be entirely abolished. This would bring the law into accord with the general practice. The same reason does not exist for the exemption in the case of corporations as exists in the case of individuals.

The effects of these suggested changes in exemptions, taken in conjunction with the proposed alterations in the income-tax rates, are set forth in detail in Appendix B.*

* *Cf. infra,* pages 128 *et seq.*

The Readjustment of Present Rates.—As has been pointed out, it is very desirable that the income-tax rates be radically reduced at the earliest practicable moment. But even though an immediate reduction should prove to be impracticable, the present rates should nevertheless be so readjusted as to bear more evenly upon the taxpayers. In the table which follows, the rates as they now stand are compared with a suggested schedule which is designed to eliminate some of the crudities of the present schedule without seriously affecting its productivity.

The practical effects of the adoption of this modified schedule of rates, taken in conjunction with the suggested alterations in the initial exemptions, are set forth in detail in Appendix B.*

Table X.—Income-tax Rates at Present in Force, with Suggested Modifications.†

	Per Cent.
At present—	
Class A—First $2,000 of taxable income	1
Class B—When income is more than $2,000 and not more than $3,000	1¼
Class C—When income is more than $3,000 and not more than $4,000	2
Class D—When income is more than $4,000 and not more than $7,000	4
Class E—When income is more than $7,000 and not more than $10,000	5
Class F—When income is more than $10,000 and not more than $20,000	7½
Class G—When income is more than $20,000	10
Suggested modifications—	
Class A—First $2,000 of taxable income	1
Class B—When income is more than $2,000 and not more than $3,000	1½
Class C—When income is more than $3,000 and not more than $4,000	2
Class D—When income is more than $4,000 and not more than $5,000	3
Class E—When income is more than $5,000 and not more than $7,500	4
Class F—When income is more than $7,500 and not more than $10,000	5
Class G—When income is more than $10,000 and not more than $15,000	6½
Class H—When income is more than $15,000 and not more than $25,000	8
Class I—When income is more than $25,000	10

The Reduction of Income-tax Rates.—The immediate reduction of the income-tax rates is urged by many interests in the Province. Thus, one of the suggestions of the Vancouver Board of Trade is that the recommendations of the Royal Commission on Taxation of 1911 be adopted in place of the present rates, with the qualification that the supertax be made to apply only to individuals and not to corporations. The Royal Commission's scale of rates is as follows:—‡

Class A—When the income of a person does not exceed $3,000, 1 per cent., with an exemption of $1,500.

Class B—When the income of a person exceeds $3,000 and does not exceed $4,000, 1¼ per cent., with an exemption of $1,500.

Class C—When the income of a person exceeds $4,000 and does not exceed $5,000, 1½ per cent., with an exemption of $1,500.

Class D—When the income of a person exceeds $5,000 and does not exceed $8,000, 2 per cent., with an exemption of $1,500.

Class E—When the income of a person exceeds $8,000 and does not exceed $11,500, 2½ per cent., with an exemption of $1,500.

Class F—When the income of a person exceeds $11,500 and does not exceed $50,000, 2½ per cent., with no exemption.

Class G—When the income of a person exceeds $50,000, 2½ per cent., with no exemption, and also a supertax of 5 per cent. on all income beyond $50,000.

As will be seen by referring to the detailed chart and the graph presented in Appendix B,§ the adoption of the scale recommended by the Commission would result in a more regular and even progression in the rates than now obtains. The reduction in the burden on the moderately large incomes ($15,000 to $50,000) is more substantial than in the very large incomes. But the rates of the Commission would yield substantially smaller returns than the present rates, but

* *Cf. infra*, pages 131, 133.

† Single rate applies to entire taxable income, the rate to be applied being determined by the group within which the income falls.

‡ Synopsis of Report and Full Report of Royal Commission on Taxation, 1911 (Victoria, 1912), page B22.

§ *Cf. infra*, pages 134, 135.

how much smaller cannot be definitely stated because of the lack of data showing the income-tax assessment by classes of income.* If the Province can afford a substantially lower scale, it would do well to adopt the recommended rates of the Royal Commission of 1911.

The present rates are very likely to prove to be disappointing in their fiscal results because of their great height. Excessive income-tax rates undoubtedly induce evasion, and evasion of such taxes is not difficult even under better conditions of administration than exist in British Columbia. Here again experience must be the guide. If the high rates prove to be demoralizing, they must be lowered and the money sought by some other method.

The Differentiation between Rates on Corporate and Rates on Individual Incomes.—The present income-tax law imposes precisely the same rate on corporate incomes as on individual incomes. The Vancouver Board of Trade petitions for a change in this policy, suggesting that the highest rates in the progressive scale apply only to personal and not to corporate incomes. The effect of this would be to make the maximum rate on corporate incomes 2½ per cent. instead of 12½ per cent. as in 1917, or 10 per cent. as contemplated for 1918 and thereafter.

The question as to whether there should be a differentiation in the rates as between corporate and other incomes is one of the hotly controverted points in public finance. There are those, on the one hand, who assert that the application of progressive rates to corporate incomes cannot be justified.† On the other hand, it is urged by others that the application of the progressive principle in this case is not only desirable, but is positively essential to the establishment of a sound system.‡ The argument of those who oppose progressive rates on corporate incomes centres about the contention that the income-tax on corporations is in reality a business-tax; that the business is owned by the stockholders, to whom the profits belong; that the proper place to apply progressive rates is upon individual incomes of which the dividends form a part, because ability to pay or burdensomeness cannot be satisfactorily measured by mere size of income in the case of corporations as it can in the case of individuals. The strongest argument for progressive rates on corporate incomes appears to be that which supports the plan on the theory that such an arrangement is conducive to progress. Most large enterprises were once small and struggling concerns, runs the argument, and great care must be taken lest the large and successful business enterprises of the future are not stifled in their present formative stages by too heavy taxation. Therefore, if it is necessary to raise large sums by taxing businesses, the burden should be made relatively heavy for the large, well-established concerns and relatively light for the small, struggling concerns.

In the case of British Columbia the argument last presented has less force than it would have in most situations, for in this Province it is not generally true that new concerns are small and that the big, successful enterprises grow from small, struggling ones through a process of gradual development. Rather, the large enterprises, the mining and lumber companies, for example, are normally of great size from the very beginning of their activities. Therefore the problem of encouraging enterprises in British Columbia is not merely the problem of encouraging small concerns, but is also the problem of encouraging large corporations to undertake very expensive developments.

But, on the other hand, the Province cannot depend upon progressive rates levied on individual incomes to meet the situation entirely, for the owners of the business enterprises in the Province reside to a very large extent outside of the Province. The process cannot be one merely of eliminating the high progressive rates on corporate incomes and increasing the rates on individual incomes, for the individual incomes are largely beyond the jurisdiction of the Province. The income must be reached at the source, if reached at all.

The new income-tax imposed by the Dominion Government subjects corporate income to the "normal" rate only (4 per cent.), but the possibility of this tax being supplemented by a new excess-profits tax must be taken into consideration. The Federal income-tax in the United States does not apply a progressive rate to corporate incomes, but in this case there is in existence a very high excess-profits tax. In the State of Wisconsin, which furnishes the closest parallel to conditions in British Columbia, the rates of the income-tax are progressive, and are higher than the rates on individual incomes.

* The assesment data are not summarized by classes of income. This could be done at very slight expense and would aid considerably in arriving at a solution of the problem of rates.

†*Cf.* A. E. Holcomb: Bulletin of National Tax Association, December, 1916, page 59.

‡ *Cf.* discussions of Professors Edwin R. A. Seligman and T. S. Adams in Proceedings of the Annual Meetings of the American Economic Association, December, 1917.

In the present impoverished condition of the Provincial Treasury it would scarcely be possible to reduce the rates on corporate income to the level advocated by the Vancouver Board of Trade. However, in the opinion of the writer, sound policy, under the peculiar conditions present in British Columbia, lies in the direction of a greater degree of uniformity in the rates applying to corporate incomes. Of course, the lower this general level of rates, the more attractive will be the Province as a field for the investment of capital in enterprises of development. The rates on corporate income may well be considered in a separate category from those on individual incomes, and be determined primarily upon considerations which have to do with the problem of attracting capital on the one hand and the need for revenue on the other.

The Application of the Income-tax.

As has been pointed out, the present tax system consists of a set of general taxes, of which the income-tax is one, coupled with a set of special taxes which are sometimes imposed in substitution for the general taxes and sometimes not. In other words, the income-tax is not universal in its application, certain types of enterprise being specifically exempted from its provisions. Again, the income accruing to individuals from the dividends of corporations paying income-taxes to the Province is ordinarily deductible in the calculation of personal income-tax returns. But the practice varies regarding the deductibility of dividends from companies subject to the special taxes. Thus salmon-canneries are taxed in a special manner on output and are not taxed on income. This is true also of coal-mines. Until recently the dividends from corporations in both types of business were deductible in calculating personal income-tax returns. At the last session of the Legislature this was changed, so far as canneries are concerned, but was not changed in the case of coal-mines.* At present, consequently, dividends from canneries are taxable as part of the income of an individual, whereas dividends from coal companies are not. Again, before last year, the specific tax on mines (other than coal-mines) operated to exempt the mining companies from the income-tax, and dividends from mining companies were deductible in calculating individual income-tax returns. In 1917, however, the Legislature, by striking out five words from section 255 of the "Taxation Act," brought the mines within the scope of the income-tax law. At the same time, by a change in Form 7, dividends from mining companies were made taxable as personal income. Thus, last year canneries, coal-mines, and metalliferous mines were on the same basis, being taxed by special charges on output, and were not subject to income-taxes. This year coal-mines remain under the old arrangement;† the cannery-owners are made subject to two taxes, because of the new income-tax on dividends; and the metalliferous mines are thrice taxed, for, in addition to the *specific* tax, they pay a new income-tax directly, and the stockholders pay the income-tax on dividends. This irregularity in the application of the income-tax apparently involves a serious lack of equity. A greater degree of uniformity is highly desirable.‡

Specific Taxes.

The specific taxes vary widely in their nature, having little in common, except that they are more restricted in their scope than the general taxes. Their fiscal importance as compared with the general taxes has already been set forth.§ Four are charges upon output, and in reality form a part of the income of the Province from the public domain. But the unit of output and the amount of the charge varies in each case. One of the remaining specific taxes is a property-tax upon a very restricted base; one is a tax on gross receipts of a restricted group of corporations; another is a rate levied upon an arbitrary valuation; one is a restricted "head" or poll tax; another is a tax on consumption, etc. It is difficult to generalize concerning this group further than to point out its heterogeneous character, and to say that it is made of some very good taxes and some very bad ones. Each will be briefly discussed in turn.

Taxes Levied on the Royalty Basis.

The Mineral-tax.—This is a levy of 2 per cent. upon the assessed value of all ore taken from metalliferous mines. The assessed value accepted for the purposes of the Act is the

* *Cf.* "Taxation Act," Form 7, deduction 7; section 8; section 115, subsection (4); section 155.
† With the exception of the slight increase in the rate on Class B coal lands.
‡ The administration of the income-tax is dealt with in another section, *cf. infra,* page 119.
§ *Cf. supra,* page 94.

"smelter return," defined as the gross value after deducting "the cost of transporting the said ore and mineral substances to the smelter or mill and the cost of treating the same."*

As explained, the specific tax was formerly in substitution for income-taxes, but this was changed in 1917,† and the income-tax now applies both to the corporation and to the dividends of such companies forming a part of the taxable income of stockholders.

The Provincial receipts from the mineral-tax for a series of years is shown in Table XI. The largest sum ever received, nearly $300,000, was realized from this source in 1917. This is more than twice the yield of 1915 and three times the yield of 1911. Such excessive variability is a shortcoming of this type of levy. In this particular situation the great increase comes, oddly enough, when revenues from other sources are declining. The explanation is, of course, the abnormal demand for metals due to the war.

Table XI.—Receipts from the Mineral-tax, 1905 and 1910-17.

Year ending—	
June 30th, 1905	$114,236 77
March 31st, 1910	102,608 93
March 31st, 1911	91,038 43
March 31st, 1912	100,659 29
March 31st, 1913	155,163 36
March 31st, 1914	153,880 73
March 31st, 1915	130,876 68
March 31st, 1916	163,335 58
March 31st, 1917	287,257 59

The Coal and Coke Tax.—Coal-mine owners pay the Provincial Treasury a royalty of 10 cents per ton on all coal produced, except on coal shipped to coke-ovens in the Province. Owners of coke-ovens pay a tax of 10 cents per ton upon all coke produced.‡ Several years ago the rate upon coke was 15 cents. The equal rate per ton on coal and coke is defended by coalmen on the ground that the difference in the quality of the coal used for coking purposes makes up for the difference between the weight of a ton of coke and the weight of the coal entering into it.

The receipts from this tax, shown in Table XII., exhibit considerable variability. Less money was received from this source in 1917 than in 1910. The yield in 1913 was 50 per cent. larger than four years later, in 1917, but a part of this difference is explained by the change in rates.

Table XII.—Receipts from Coal and Coke Tax, 1905 and 1910-17.

Year ending—	
June 30th, 1905	$ 94,682 45
March 31st, 1910	222,722 91
March 31st, 1911	248,332 86
March 31st, 1912	195,207 78
March 31st, 1913	302,225 35
March 31st, 1914	192,590 14
March 31st, 1915	158,867 25
March 31st, 1916	173,261 75
March 31st, 1917	194,536 62

Timber Licences and Royalties.—The various types of charges imposed upon timber are essentially specific taxes in their nature, but they are not considered a part of the tax system proper, probably because it has been found desirable to place them under a separate administrative organization. The accounts still show a small return from an old form of timber lease, long since abandoned.§ For a considerable period charges were imposed in the form of licence fees payable for the privilege of cutting and in the form of royalties upon the amount of timber cut. Revenue still accrues in large amounts from these sources, but the current method of

* "Taxation Act," section 160. Ore-producing mines whose output is of less value than $5,000 receive a rebate of one-half of the tax. Placer and dredging mines with a product of less than $2,000 are tax-free.

† *Cf. supra*, page 109.

‡ "Taxation Act," sections 119, 120.

§ Pulp-wood leases are still issued.

levying a charge for the privilege of utilizing the timber resources of the Province is to cruise the land and sell the privilege upon the basis of the report of the cruise.*

In the accounts the receipts from timber royalties are not stated separately from the receipts from licences, although the charges are sufficiently different to justify the distinction. In Table XIII. this separation is made. The royalties are true output-taxes varying with the quantity of timber cut and the prevailing prices. Here once more the variability of this type of charge is very apparent. As in the case of the mineral-tax, 1917 was the banner year, showing an increase of more than 50 per cent. over the previous year. The licences are not output-taxes at all, but are charges levied on the acreage basis. Their productivity was highly uniform until 1915, when a decline began, not because of a diminution in the levy, but because of difficulties of collection. So serious did the pressure become that an Act was passed establishing a moratorium for timber licences for a limited period. This period having now expired, the fees must be paid, and the receipts can be expected to approach normal once more.

Table XIII.—Receipts from Timber Royalties and Licences, 1905 and 1910-17.

Year ending.	Royalties.	Licences.	Total.
June 30th, 1905	$205,000 00†	$ 205,000 00†	$ 410,288 29
March 31st, 1910	305,198 00	1,928,901 31	2,234,099 31
" 31st, 1911	435,888 71	1,922,062 61	2,357,951 32
" 31st, 1912	422,116 84	1,878,146 44	2,300,263 28
" 31st, 1913	517,672 19	1,939,457 18	2,457,129 37
" 31st, 1914	463,204 17	1,980,974 89	2,444,179 06
" 31st, 1915	373,439 76	1,381,679 88	1,755,119 64
" 31st, 1916	361,247 16	1,116,131 10	1,477,378 26
" 31st, 1917	567,292 85	1,192,176 31	1,759,469 16

† Approximate.

Tax on Canneries and Whaleries.—Salmon-canneries and whaleries were formerly taxed on the basis of their property, but several years ago the charge was changed into output-tax.‡ Canned salmon is subject to a tax of 4 cents a case of forty-eight 1-lb. tins. "Mild-cured salmon" is taxed 75 cents a tierce of 750 lb. or under, and 10 cents per 100 lb. for additional weight. Cured or pickled salmon pays a charge of 15 cents a barrel and "dry-salted" salmon a charge of 5 cents per hundredweight.

Manufacturers of whale-oil are taxed 10 cents per barrel (46 gallons). On fertilizer whale-bone and bone-meal they must pay a rate of 20 cents per ton.

The extensive halibut and herring fisheries are not subjected to an output-tax.

The receipts of the taxes on salmon and whales are not shown separately in the accounts, but a conception of their slight fiscal significance can be gained from the statement that the gross levy in 1917 amounted to only $40,762.64.

In connection with the various taxes on output, there are points which, in the course of even a hasty survey, raise serious questions regarding the advisability of continuing the taxes in their present form. Any readjustment, however, should be based upon a more thorough investigation than it has been possible thus far to make. Full data are needed to establish any relationship between the various rates upon units of output and the real burdens upon the industries affected. Without a clear conception of this relationship no policy can be formulated which is wise and just.

From one point of view this series of royalty charges may be considered a definition of the basis upon which the Province will agree to permit its natural resources to be exploited. Apparently the justification of these charges rests upon the theory that the Province is really the owner of the mines, forests, and fisheries, and permits them to be developed upon the condition that the proceeds be shared in the fashion specified. Whether the charges imposed are proper ones and well adapted to the situation depends partly upon the plan of development to which the Province stands committed. The higher the royalty demanded, the slower, of

* *Cf.* chapter 36, Laws of 1917.
‡ "Taxation Act," sections 114-117.

course, the development which may be expected. Moreover, such royalties are essentially of the nature of bargains with those who are engaged in enterprises of development, and as such they are variable to a less degree than is true in the case of ordinary taxes. It may be desirable to distinguish between new and old enterprises in arranging these charges, in case changes are to be made. Judged by the criteria of justice applicable to ordinary taxes, these royalties have little to commend them.

Because of the lack of opportunity to go into the local situation thoroughly, the writer must refrain from making specific recommendations. The survey made, however, leaves the impression that this is a portion of the field which would repay more intensive cultivation.

OTHER SPECIFIC TAXES.

Tax on Unworked Crown-granted Mineral Claims.—A special penalty of 25 cents per acre is imposed on mining property held by Crown grant and not worked. The tax is of long standing and apparently provokes no opposition. In its nature it is similar to the tax on wild lands and on unworked coal land, and what has been said of the theory of these taxes applies here as well.*

The receipts from this tax, shown in Table XIV., are remarkably constant quantities, but are not important in size.

Gross-receipts Tax.—The following types of corporations, in lieu of taxes on personal property and net income, are subject to a special tax upon their gross income: Insurance companies; guarantee, loan, and trust companies; telegraph, telephone, and express companies; gas, waterworks, and electric lighting, power, and street-railway companies.† It will be noted that this group includes many of the corporations which operate over a wide range of territory, and in such cases gross income constitutes a base much more easily ascertainable for purposes of taxation than net income. The rate upon the gross income of these corporations was formerly 1 per cent. In 1917 it was made 2 per cent. The financial significance of this tax cannot be shown, for, peculiarly enough, no separate statement of the receipts is made in the records of the Province.

Table XIV.—Receipts from the Tax on Unworked Crown-granted Mineral Claims, 1905 and 1910-17.

Year ending—	
June 30th, 1905	$39,869 86
March 31st, 1910	39,869 65
March 31st, 1911	42,020 84
March 31st, 1912	43,436 00
March 31st, 1913	42,733 43
March 31st, 1914	45,953 83
March 31st, 1915	40,296 71
March 31st, 1916	35,703 23
March 31st, 1917	37,903 97

Banks, operating as they do largely through branches, constitute a type of corporation similar to those included under the gross income-tax. But banks are taxed in a special manner. In place of the tax on non-productive personal property and on income (but in addition to the tax on real estate), banks are subject to annual specific taxes as follows:—

For one branch or office	$1,500
For additional branches	250

These rates were not disturbed in 1917 when the rates on other corporations were raised, the banks having agreed to suggest, in time for action in 1918, a more equitable method of distributing the burden among the institutions than the present one. Obviously the system now in force is crude to an unnecessary degree.

* *Cf. supra,* pages 97-8.

† There is a modification of this tax in the case of every corporation "which has its property and business wholly within and confined to this Province and has derived its power by Statutes from this Province, whereby the prices to be charged by it for public services have been limited by any Statute of the Province or by any municipal by-law." Such a corporation pays only one-half the ordinary rate whenever its operating expenses exceed 50 per cent. of its gross revenue in any one year.—"Taxation Act," section 8, subsection (27).

The Railway-tax.—Railways are taxed upon an arbitrary assessment and at an arbitrary rate. The land claimed as right-of-way, the personal property, the income, and the rolling-stock are grouped together as a whole and taxed as real estate. All this property is assessed arbitrarily at $10,000 per mile of main track and branches and $3,000 per mile of sidings, spurs, and switches.* The rate, which formerly was 1 per cent., was increased in 1917 to 2 per cent.† The receipts are not differentiated from the receipts from real estate in general.

The problem of railway taxation in British Columbia is by no means a simple one, with its medley of old companies and new companies, its special exemptions, its subsidies, and its bond guarantees. To tax all railways, however, at the same figure per mile is so rough and inexact a method as to be acceptable only when the tax burden is insignificant. If the railways are asked to bear heavy taxes, a more equitable method than the present one should be applied to apportion the burden among the various companies.

The Revenue or Poll Tax.—Formerly a poll-tax of $3 was an important source of Provincial revenue, yielding in 1912 the large sum of $381,432. The receipts are shown in Table XV. The tax, however, was unpopular, and upon the recommendation of the Royal Commission on Taxation‡ was abandoned in 1913.§ The principal objections to the tax as set forth by the Commission are that it is a primitive tax suited only to the early stages of civilization, and that it has a tendency to obstruct the free flow of labour. These disadvantages, however, did not prove weighty enough to prevent the reintroduction of the poll-tax under the conditions of financial stress present in 1917. The new law‖ provides for the payment of $5 annually by every male person not specifically exempted. The principal exempt class consists of all persons who have paid municipal or Provincial taxes to the amount of $5. This class is so large as to affect very seriously the productivity of the tax. In administering the tax the Province utilizes the employers of labour, who are held liable for the tax and are permitted to deduct the amount from wages. A receipt for taxes paid is the evidence required to secure exemption. In many cases ordinary taxes are not paid until later in the year than the poll-tax, and the problem of rebating poll-tax collections improperly made is one which has caused much vexation both to employers and Provincial officers.

Table XV.—Receipts from the Revenue (Poll) Tax.

Year ending—	
June 30th, 1905	$157,821 00
March 31st, 1910	260,682 00
March 31st, 1911	313,338 00
March 31st, 1912	381,432 00
March 31st, 1913	360,663 00
March 31st, 1914	3,558 00
March 31st, 1915	30 00

This administrative problem would find its solution in the elimination of the taxpayer exemption clause. If the poll-tax is to be retained at all, this action might well be taken.

Some of the objections to the poll-tax arise from the fact that it is considered as a tax by itself rather than as part of a tax system. Here it might possibly be considered as a part of the income-tax—as a minimum income-tax payable by those whose incomes are so small as not to justify the administrative expense of drawing up a declaration. The strongest support for the tax in British Columbia, however, appears to come from those who consider it a means for reaching certain classes in the community who are reached by taxation in no other way, particularly the Orientals. So far as the primitiveness of the tax is concerned, the great bulk of the Province can scarcely to-day be considered to have reached a high level of economic development.

After all is said and done, however, there is little enough excuse for the existence of the tax. The elimination of some of the exemptions would simplify the administration, increase the yield, and improve the equity of the tax. But it is one of the least desirable of the forms of taxation being utilized at present, and should be definitely slated for repeal as soon as the state of the Provincial finances will permit.

* Buildings used for other than railway purposes are taxed as ordinary real estate.
† "Taxation Act," section 193.
‡ Report, pages 6, 16, 19.
§ Laws, 1913, chapter 71, section 11.
‖ The "Poll-tax Act," assented to May 19th, 1917.

Succession Duties.—As is shown in Table XVI., very considerable sums have been received annually from probate and succession duties. Rates formerly ranged up to 10 per cent. The present scale of succession duties, ranging up to 20 per cent., were adopted in 1917.* There is a probate duty on personal property which varies from nothing in the case of the closest relatives to 5 per cent. to the group furthest removed.

These rates, although not so high as those resulting from the combination of the Federal and State rates in some places in the United States, nevertheless compare favourably with the rates in many of the foreign countries, and justify careful safeguards, such as provisions guaranteeing against the repeated payment of the tax on the same estate within a few years. One of the assets of British Columbia is its attractiveness as a place of residence, and the Province has a special problem in that care must be exercised lest high inheritance-taxes prove a bar to wealthy home-seekers.

Table XVI.—Receipts from Succession Duty, 1905 and 1910-17.

Year ending—	
June 30th, 1905	$ 31,073 08
March 31st, 1910	108,495 39
March 31st, 1911	200,459 88
March 31st, 1912	152,243 93
March 31st, 1913	193,523 90
March 31st, 1914	249,275 37
March 31st, 1915	162,277 60
March 31st, 1916	139,907 23
March 31st, 1917	277,702 73

The Motor-tax.—The owners of motor-vehicles in British Columbia are taxed in a manner which is unnecessarily complicated and expensive. There is a $10 registration fee paid once only, and a $10 licence fee paid annually. In addition, the machine is taxable as personal property. Table XVII. shows the receipts under the "Motor-traffic Regulation Act," which do not include the personal-property taxes on motor-cars, but do include certain other fees than merely the registration and licence fees.

Table XVII.—Receipts from the "Motor-traffic Regulation Act."

Year ending—	
March 31st, 1914	$ 98,530 76
March 31st, 1915	110,446 43
March 31st, 1916	94,892 30
March 31st, 1917	134,361 50

It is recommended that all of the three charges now levied be merged into an annual licence fee which will vary the type of motor-vehicle, but which is estimated to yield in all approximately the same revenue as the present miscellaneous charges. Under the present arrangement there is not sufficient differentiation between the owners of the various classes of motor-cars, and there is too much difficulty in administering the personal-property tax as applied to automobiles. It is believed that the suggested change will make the charges more equitable, will tend to eliminate evasion, and will reduce administrative expense.

The Amusement-tax.—In 1917 a tax upon amusements was introduced in British Columbia.† It provides that every person attending a performance at a place of amusement shall pay a small tax based on the price of admission, as follows:—

Price of Admission.	Tax, Cents.
Not more than 5 cents	1
More than 5 cents but less than 15 cents	2
More than 15 cents but less than 25 cents	3
More than 25 cents but less than 40 cents	4
More than 40 cents but less than 75 cents	5
More than 75 cents but less than $1.25	10
More than $1.25 but less than $1.50	15
More than $1.50 but less than $2.00	20
More than $2.00 but less than $2.50	25
More than $2.50	50

* Laws of 1917, chapter 60.
† Laws, 1917, chapter 63.

These rates, although somewhat differently arranged, are not appreciably higher on small admissions than the rates in force in the adjoining territories of Alberta and the United States, the rate in the United States being 10 per cent. of the admission charge, and in Alberta 2½ cents per ticket, provided the charge is less than $1.

The amusement-tax is, in the opinion of the investigator, a very undesirable form of tax, and one which should be abandoned entirely as soon as the condition of the Treasury warrants it. It might be justified as a war measure designed to discourage a non-essential enterprise, but no effort is made to justify it on this basis in British Columbia. Here it is merely a revenue measure, and, as such, care should be exercised lest the level of rates or their arrangement discourage the business and impair the source of revenue. It is asserted by the motion-picture interests that the present rates operate to discourage patronage. If this is true, and it should be possible to demonstrate the truth or falsity of the statement, it is to the interest of the Government as well as to the interest of the business that the rates be revised.

This tax is of a type which usually produces irritation entirely out of proportion to its yield, and which distributes the burden with reference to no defensible principle of taxation. Where most successful, the irritation is usually alleviated by making the tax a special one whose proceeds are devoted to some particularly popular purpose. Thus in Alberta (perhaps improperly so) and in the United States the amusement-tax is known as a distinctively war-tax, while in Montreal the city's share of the proceeds goes to the support of hospitals. In British Columbia it might be arranged so as to make the tax a patriotic levy or a charge to assist in carrying the railway-bond burden, on the theory that this would bring home to the people the undesirable results of reckless financing.

The foregoing discussion* has proceeded from the point of view of the revenue system as a fiscal machine, and has therefore concerned itself narrowly with types of taxes, the level of rates, and the money yields, reserving the broader questions of the distribution of the tax burden for treatment in the succeeding sections. Some general observations should, however, be made at this point.

It is apparent that, as it now stands, the tax system is a bewildering complicated mixture of good and bad features. There is much that is worthy of praise, for a persistent effort has apparently been made to appropriate new developments in the field of taxation. On the whole, however, the tax system as it stands must be described as exceedingly rough and crude. The income-tax is really scarcely an income-tax at all, so inexact is the definition of income laid down in the law. The special tax on banks does not differentiate between the prosperous and the unsuccessful institution, provided only they both have the same number of offices. The railway-tax does not distinguish between the railroad which pays enormous dividends and the road which is in the hands of the receiver, provided they both have the same number of miles of track. Two coal-mines pay the same tax if they turn out the same number of tons of coal, although one may be making much money and the other none whatsoever. Some of the rates are so adjusted as to defeat the very purpose of the tax, as in the case of the wild-land tax, the raising of a revenue for the Province.

Improvement in the tax system should take the direction of the simplification and co-ordination of the taxes already in existence rather than the addition of new types of imposts. There are too many kinds of taxes in force already. A properly developed and administered income-tax, for example, should make it possible to eliminate or merge with it the personal-property tax as well as a number of the specific taxes.

It is definitely recommended that several of the taxes be entirely eliminated as soon as this action can possibly be afforded; e.g., the poll-tax, the amusement-tax, and the personal-property tax. It is also pointed out that the rates being levied in at least two cases—i.e., the income-tax and the wild-land tax—are so high as to be unsafe. At the present level they endanger the integrity of the financial system.

* The following points have been suggested as worthy of study with a view to changes, but the writer has not been able to consider them because of lack of time:—

(1.) *Registry Fees.*—It has been suggested that the amount of these fees be made to vary with the increase in the value of the land between transfers, the fees, however, being kept so low as to cause them to remain essentially fees rather than taxes.

(2.) *Water Revenue, Rentals.*—The administration of these rentals is said to be susceptible of considerable improvement which, if accomplished, would result in increased revenue.

(3.) *Timber Leases and Licences.*—Both leases and licences are transferable and often appreciate greatly in value. It has been suggested that there may be a basis here for the imposition of an increment tax.

The need for revenue is so great that recommendations for changes in the tax system are conditioned fundamentally upon their financial practicability. Most of the suggestions made at the hearings were in the direction of reducing rather than increasing the productivity of the taxes. The really important question is what refinements the Province can at this time afford to make, and this is a point for the Government rather than for the investigator to decide.

THE DISTRIBUTION OF THE PRESENT TAX BURDEN.

Turning from a survey of the tax system strictly as a revenue-producing machine, attention is directed to a broader aspect of the problem—that connected with the distribution of the tax burden. As the result of the imposition of the various taxes described above and the division of taxing powers among the various governmental authorities, what are the results obtained in terms of burdens imposed? And how closely does the weight of these burdens coincide with ability to bear taxes?

THE DISTRIBUTION AMONG THE VARIOUS ECONOMIC INTERESTS.

The scientific reorganization of the tax system presupposes definite knowledge of conditions. If the burden is to be readjusted so as to rest where it can most easily be borne, it is necessary to have full and exact information regarding the local situation. Since the investigator did not have the opportunity to acquire this detailed information, he is not in a position to proceed in a confident manner to outline a comprehensive scheme of reorganization. What is needed is a field investigation which would inquire carefully into the effects of the present system upon the various economic interests, and which would gather data for forming estimates of the probable effects of adopting various possible readjustments.

How the present system could be expected to result in an equitable distribution of the tax burden is beyond the comprehension of an unbiased observer. Even a brief examination of the nature of the various taxes imposed and of the history of modifications made in those taxes is sufficient to convince one that the tangled web of special charges and special exemptions conceals very serious inequalities.

To make comparisons it is necessary to reduce the elements to some common basis. Where a single tax is applied uniformly comparisons are readily made. But under the British Columbia tax law almost every interest is taxed upon a different basis and at a different rate. The assessment and tax data yield almost no information for drawing conclusions as to relative burdens. An inquirer who would know whether the coal-mining industry is heavily taxed as compared with the metal-mining industry must combine the various miscellaneous charges resting on each, and compare them with data regarding the economic strength of the industries gathered from some other source than the tax records. The fact that salmon-canneries are taxed 4 cents per case on output tells nothing concerning the relative weight of the burden borne by this interest compared with that borne by banks. But it is difficult to escape the conclusion that coal-mines taxed merely on the royalty basis are equitably treated as compared with metalliferous mines, which, in addition to royalties, pay taxes on income and dividends. And it is not easy to see the equity in increasing 50 per cent. the taxes on Crown-granted timber lands when the charges are not increased upon timber companies drawing their supply from other sources than Crown-granted lands.

The simplification of the taxes and the equalization of the burden should be one of the tasks entrusted to a capable permanent Tax Board. To this Board should be given power to secure expert advice concerning the many highly technical problems involved.

THE DISTRIBUTION BETWEEN THE PROVINCE AND THE MUNICIPALITIES.

The relationship of Provincial and local revenues becomes of great importance in connection with the proper apportionment of the tax burden, and in any readjustment the presence of municipal levies cannot be ignored. Moreover, the Province must have a proper regard for the sources of municipal revenue.

The financial situation in some of the cities of the Province is the occasion of considerable concern. Indeed, unless real-estate values should show a remarkable improvement, the Province may soon be face to face with the problem of extending substantial relief to certain municipalities. The movement toward the single tax, however valuable the social effects may have been in encouraging building or checking speculation, has resulted in the imposition of a strain upon

speculative land-values which has seriously affected their productivity as a source of municipal revenue. If the present real-estate depression continues, it is certain that Victoria, Vancouver, and perhaps some other municipalities will be compelled to reorganize their revenue systems.

At the present time real estate in some municipalities is assessed at levels which are indefensibly high. Moreover, the Province apparently sanctions and encourages this practice. Thus clause (*c*), subsection (227A), of the 1916 amendment to the "Municipal Act" states that in certain districts there shall be no appeal in respect to the assessment "if the assessment of the land in question is fair and equitable in comparison with other lands of the same class in the municipality, such comparison to be made by reference only to the assessment roll of the municipality for the year 1914." In sending out assessment notices, one Assessor naively asserts that "the fact that there is little or no market value for real estate does not affect the assessment." When it is necessary to bolster the assessment by such methods, it is time to arrange for additional sources of municipal revenue.

The situation being as it is, the request of the Vancouver authorities that the right to levy a business-tax be safeguarded the city should be readily granted. Indeed, it is a serious question as to whether it is not now incumbent upon the Province to exercise its authority to compel the municipalities to levy other taxes in addition to the taxes on land-values which are proving themselves so difficult of collection.

In view of the great assistance extended to municipalities from the Provincial Treasury, the application for the remission of a portion of the motor-vehicle fees and the receipts from the amusement-tax is probably not worthy of favourable consideration in the present exigency. It is the current practice in all of the Provinces with which the investigator is familiar to consider the motor licences peculiarly a Provincial source of revenue. In the United States the City of New York has recently secured the remission of a portion of these fees, but it is decidedly an unusual practice. Alberta rebates none of the amusement-tax to municipalities. Quebec, it is true, gives a certain amount of it to Montreal, but this is because Montreal already imposed an amusement-tax which was incorporated into the Provincial system.

The Distribution between the Province and the School Districts.

The burden of supporting schools in British Columbia is assumed to a very large degree by the Province, liberal grants for educational purposes being made even to the most populous and prosperous of the cities. For the year 1915-16 the total expenditure from the Provincial Treasury for school purposes was $1,591,322.43.*

The problem of financing the schools in the outlying districts is one which has occasioned considerable discussion in the Province. Formerly the cost was defrayed entirely from the Provincial Treasury, but recently an attempt has been made to charge a portion of the cost to the locality. The amounts involved are not large, only $122,836.18 having been raised locally in these districts in 1915-16.† Because of the absence of local machinery the administration of the school-tax was made a function of the Provincial Department of Taxes. A tax base, somewhat different from the Provincial tax base, is utilized, and this involves considerable additional labour for the Provincial Assessors. Local school authorities are permitted to request that a certain sum be raised for school purposes and to draw upon the Province for 75 per cent. of the amount. Collections are often slow, and as a result many complaints are made by the local school officials. Finally, the amounts charged to the individual taxpayer are sometimes so small that the expenses of collection exceed the sum involved.

The Provincial educational authorities insist that the importance of the local tax levy in the unorganized school district is very great and resent any proposal to eliminate it. On the other hand, a tax which costs more to administer than it yields is a fiscal absurdity. It may be possible to change the tax base so as to identify it with the Provincial base, eliminating the expense of separate records, notices, etc., and thus reducing the administrative costs to a reasonably small fraction of the yield. If this cannot be accomplished, the suggestion of Mr. McKilligan should be adopted—viz., that the expenses of the schools in these districts be made a charge payable out of general Provincial funds, but made good by an increase in the levy upon the real estate in the unorganized territory as a whole.

* Public Schools Report, 1915-16, page 15.
† Public Schools Report, 1915-16, pages 15, 17.

THE ADMINISTRATION OF THE TAX SYSTEM.

Already several administrative questions have been referred to incidentally.* It is now proposed to discuss as fully as the available data will permit the general question of the degree of success attained in the administration of the tax laws of British Columbia, and to suggest certain changes which it is believed will increase the efficiency of the organization.

ASSESSMENTS.

Quality of Assessments.—The efficiency of the administrative organization is to be judged by the fulness and accuracy of assessments and the promptness and completeness of collections. On neither count can the administration in British Columbia be said to have achieved success.

Although lack of time made it impossible to conduct an extensive, first-hand investigation into the quality of the assessment, the testimony of witnesses who appeared before the Board, together with the frank admissions of various officials, convince the investigator that the assessment, particularly of personal property and income, is open to very serious criticism. It is apparently a matter of common knowledge that the Provincial officials with their present organization are impotent to secure full and accurate income and personal-property returns. The testimony regarding the quality of the real-estate assessment is somewhat conflicting, but evidently there is considerable unevenness. There are complaints concerning overvaluation, some of which are based on the ground that there have not been reductions recently to meet the slump in realty values. But the officials contend that they were very conservative in raising values during the prosperous years and that present values do not on the whole represent an overvaluation.

The Present Assessment Force.—No substantial change has been made in the machinery of assessment for fifteen years. The administration is headed by a Surveyor of Taxes and Assessments who has the assistance at headquarters of a single clerk and stenographer.† The Province is divided into thirty assessment districts, with an Assessor at the head of each. In the districts which include a city the Assessor is usually provided with assistants. In many districts, however, not only is no assistance furnished, but the Assessor, in addition to his tax duties, is burdened with numerous other functions. It is pointed out by Mr. McKilligan that the assessment force from top to bottom is inadequate to the task of accomplishing satisfactorily the work assigned. Many of the Assessors are said to be able to do little in the way of revision and merely copy the rolls from year to year without alterations.

A Permanent Tax Board.—It is imperative that an administrative organization be built up which is capable of solving the difficult assessment problem of British Columbia. In the opinion of the writer, there should stand at the head a permanent Tax Board of dignity, power, and responsibility. Such bodies have commended themselves as the result of long and varied experience in two-thirds‡ of the States of the Union. The administrative Boards in control of taxation in such States as Wisconsin, Michigan, New York, and Kansas furnish examples of the general character of the organization which is desirable. The tax problems of the Province are many, and the work is of sufficient importance to justify the creation of such a Board.

The Board should be composed of three members, appointed by the Lieutenant-Governor in Council for a term of at least four years. The salary should be sufficient to attract men of good calibre. Every effort should be made to render the Board independent and non-political, and to this end it might be well to follow the precedent of Saskatchewan, where the members of the Local Government Board are disfranchised upon the acceptance of their appointments.

To this Board should be granted wide powers and adequate funds.

The Reorganization of the Assessment Force.—The administrative organization which will best meet the demand for a more complete and exact assessment is a problem which should be left to the Tax Board so far as details are concerned. If the personal-property tax were abolished and the income-tax administration merged with the Federal machinery, the remaining problem of real-estate assessment could probably be best met by a corps of trained men devoting their entire time to the work, working under central direction and control. This would involve, of course, the entire reorganization of the present assessment districts.

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* *Cf. supra,* under the various headings.
† Recently steps have been taken to provide an assistant and a temporary auditor.
‡ In thirty-five out of the forty-eight States in 1916.

Appeals of Dissatisfied Taxpayers.—At present appeals from assessments are heard by a Judge especially appointed for the purpose and paid on the per diem basis. The results obtained under this arrangement are reported to be unsatisfactory. The consideration of appeals and the revision and equalization of the local assessments might well be made a part of the work of the Tax Board, the members of which might act with or without the co-operation of local representatives. Further appeal to the Supreme Court of the Province should be retained, as at present.

Separate Assessment of Lands and Improvements.—A measure whose adoption could be confidently expected to yield a greater degree of accuracy in real-estate assessments is the requirement that in assessing real estate the value of the land be stated separately from the value of the improvement. At present the value of the entire improved parcel is entered as one item.

Assessment Costs.—The accounts of the Province are not so arranged as to make possible a statement of the expense involved in the assessment procedure.

Utilization of Federal Income-tax Machinery.—It is possible that the presence of the new Federal income-tax can be made to assist to some degree in the administration of the Provincial income-tax. It is desirable that some plan of co-operation be adopted which would make it possible to utilize the same return for both Federal and Provincial income-taxes. Provided the combined rates were not inordinately high, the plan should prove advantageous to both Governments and to the taxpayer, preventing evasion on the one hand and eliminating the inconvenience of two returns on the other. An amendment to the Federal law permitting the use of the Federal returns by Provincial income-tax officials would be the best method of gaining the end in view, but it could be accomplished in a fairly satisfactory manner by requiring each Federal income-tax payer in the Province to submit to the Provincial authorities a copy of his Federal return. The last plan is being used successfully in connection with the taxation of corporations in the States of Connecticut and New York.

COLLECTIONS.

The measurement of the degree of success achieved in collecting taxes is usually the simple process of comparing the collections with the levies. But, strange as it may seem, in British Columbia it is not possible to make this comparison exactly with the data available from the Provincial records. It has apparently been the practice to measure success of collections by comparing collections of one year with collections of preceding years rather than by comparing collections with levies!

Taxes are due January 2nd.* A discount of 10 per cent. is given if payment is made before July 1st. They become delinquent December 31st† and bear interest after that date at the rate of 6 per cent. per annum.‡

It will be noted that the tax-collection period does not coincide with the fiscal year. This causes confusion, for the receipts shown in the Public Accounts for a given fiscal year include portions of the levies of several years. Thus any taxes which are paid during the first three months of the new tax year are merged with the taxes received during the nine months of the old tax year, and in addition no distinction is drawn between receipts from the levies of the (two) current tax years and the receipts from the levies of previous tax years, now in arrears. Consequently close comparisons between levies and collections are impossible. If the tax year were made to coincide with the fiscal year, and the tax receipts allotted by the year of levy, definite information would be available concerning the efficiency of the collection service. At the present time to secure a statement of taxes outstanding it is necessary to send a special request to all Collectors, who must then make up the statement from their books.§

The Amount of Arrears.—Great difficulty has been experienced of late in collecting taxes, and the arrears have now reached alarming proportions. It was reported by the special auditors that on November 30th, 1916, the total outstanding taxes amounted to $3,804,794.21.‖ This

* "Taxation Act," section 105.
† "Taxation Act," section 211.
‡ "Taxation Act," section 212.
§ The numbered receipts issued by the Collector constitute practically the only system of control over the Collector, and this is so indirect as to be but little insurance against irregularity. Good financial practice demands that the Collectors be directly charged with the responsibility of accounting for definite sums, and that control be exercised to an extent sufficient to enforce this responsibility.
‖ This figure, moreover, did not include an item of $166,502.96, outstanding taxes for rural schools.

included the outstanding taxes of the current year's levy, which could not properly be termed arrears until the end of December. But December collections did not materially reduce that amount, and the total arrears on January 1st, 1917, stood at $3,698,195.18, distributed as follows:—

Table XVIII.—Total Accumulated Arrears, January 1st, 1917 (compared with 1916 Levy).

	1916 Levy.	Total Accumulated Arrears.
Improved real estate	$ 686,688 31	$ 537,296 24
Wild, coal, and timber lands	1,262,825 79	2,681,894 77
Personal property	343,644 23	249,455 18
Income	350,045 80	229,548 99
Totals	$2,643,204 13	$3,698,195 18

The total accumulated arrears are contrasted with the current levies for 1916 in Graph IX. It will be noted that the arrears outstanding at the first of this year exceeded by approximately 25 per cent. all of the taxes levied on these classes of property in 1916. Taxes on income have shown themselves to be the most collectable of all the taxes, but even in this case the total arrears exceeded 65 per cent. of the current year's levy. That this is not a creditable showing will be realized by comparing the figures with those for the State of Wisconsin, where the total accumulated income-tax arrears amounted on June 30th, 1916, to only $105,286.73, less than 2 per cent. of the 1916 levy.*

Personal-property arrears amount to approximately 70 per cent. and improved real estate arrears to almost 80 per cent. of the current levy. The weakest element in the tax base, however, is also the one upon which chief dependence is placed, the taxes on wild, coal, and timber lands. Here the accumulated arrears are now more than twice as great as the current year's levy.

The seriousness of the situation may become very strikingly apparent from a consideration of the statistics of current arrears. Of the taxes levied in 1917, nearly one-half were not collected within the legal period and lapsed into arrears.† The accompanying table (Table XIX.) and graph (Graph X.) show that in the case of wild, coal, and timber lands the taxes collected amounted to only one-third of the levy. The income-tax again appears to have the best record, with personal property and improved real estate following in order.

Table XIX.—Portion of 1916 Tax Levy going into Arrears on January 1st, 1917.

	1916 Levy.	Arrears of 1916 Levy.
Improved real estate	$ 686,688 31	$ 200,114 02
Wild, coal, and timber lands	1,262,825 79	798,070 77
Personal property	343,644 23	82,834 34
Income	350,045 80	48,845 91
Totals	$2,643,204 13	$1,129,865 04

That this is a condition which has not always existed, but is rather one which has gradually developed until it reached its present large proportions, is shown by the data presented in Table XX. and Graph XI. Here the total annual levies are compared with the cash receipts for the fiscal years. Although the nature of the data makes this comparison a somewhat unsatisfactory one,‡ it is possible to draw general conclusions. It is very evident, for example, that the habit of not paying taxes is becoming more general with each year, and that, whereas eight years ago it was a question of no quantitative importance, it has grown to be a matter of serious financial concern.

* A large share of these arrears were unpaid merely pending the result of litigation.—Report of the Wisconsin Tax Commission, 1916, pages 58, 65.

† The total current year's levy ($2,643,204.13) minus the cash discount (maximum $264,320.41) equals $2,378,883.72. The arrears at the end of the year were $1,129,865.04. The amount paid, ignoring the added amount because of the discount not available after July 1st, was therefore $1,249,018.68.

‡ This is because the receipts are not receipts from the current year's levy merely, but rather include other elements.

Graph IX.—Total Accumulated Arrears at End of 1916 compared with the Tax Levy for 1916.

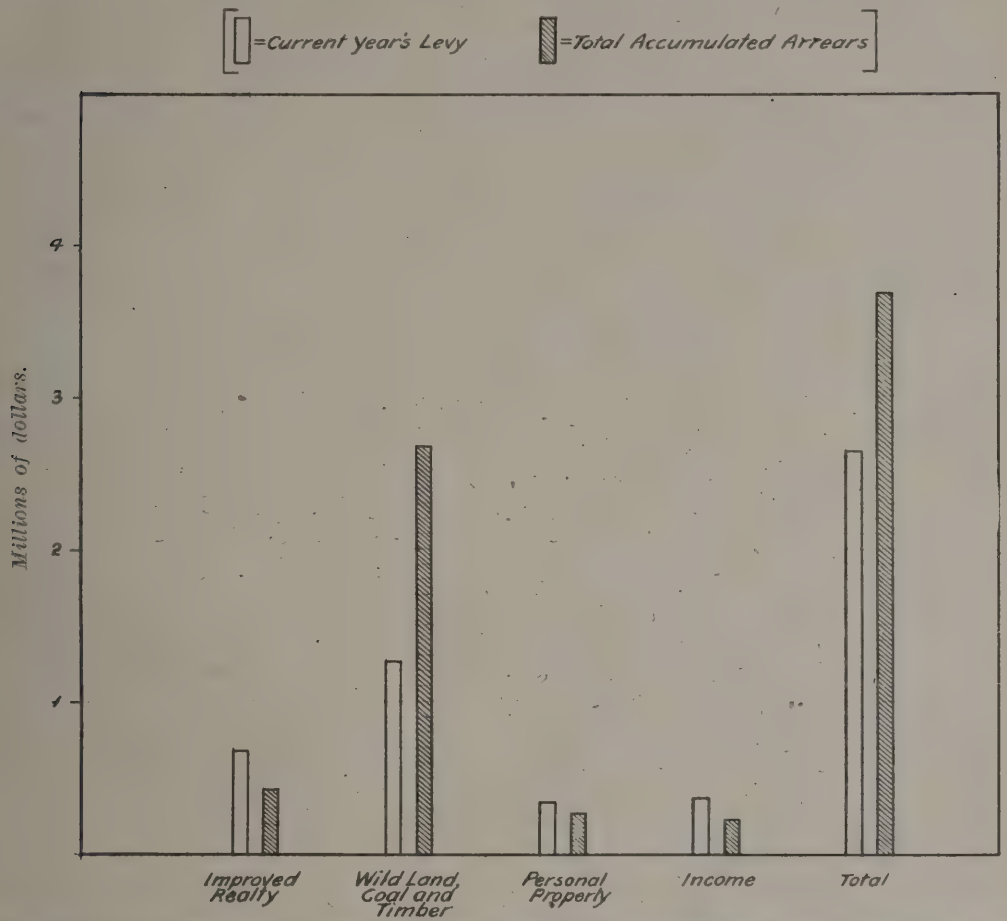


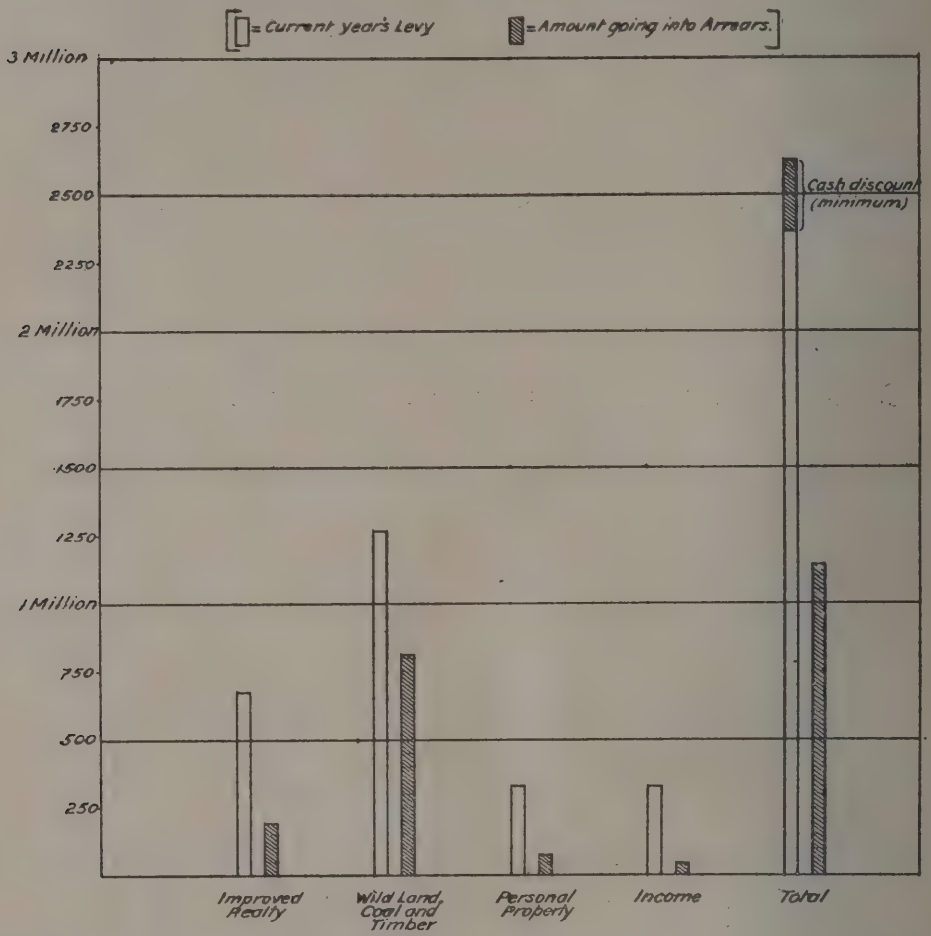
Table XX.—A Comparison of the Total Tax Levies on Improved Real Estate, Wild, Coal, and Timber Lands, Personal Property, and Income, with the Total Cash Collections from these Sources by Fiscal Years, 1909-17.

	Tax Levy.	Total Receipts.*
1909	$1,083,276 06	$ 939,326 01
1910	1,301,385 43	1,040,480 75
1911	1,450,830 08	1,224,349 99
1912	1,996,844 33	1,483,750 92
1913	2,372,414 26	1,720,795 62
1914	2,829,686 40	1,850,725 80
1915	2,556,017 65	1,635,097 21
1916	2,643,204 13	1,641,646 69

Reasons for Collection Difficulties.—The reasons for this unfavourable showing are several. First of all, the general economic conditions are such as to make tax-paying more difficult for the citizen than it was a few years ago. The large profits of the highly speculative period which ended in 1914 are now lacking to a very considerable extent. Again, many of the taxes are considered in the light of a fee being paid to the Province for the privilege of speculating upon variations in the price of land, and in a large number of cases the game is no longer worth the candle. But in addition to these reasons there is one which is probably more important than either—i.e., the failure on the part of the Government to apply any measures of compulsion

* For fiscal year ending March 31st of the following year.

Graph X.—Portion of 1916 Tax Levy going into Arrears, January 1st, 1917.



upon the taxpayers. In spite of the fact that, under the law, tax sales should be regularly held, there has been no sale of property to enforce the collection of Provincial taxes since the year 1913. Largely as a consequence of this attitude the people of the Province have come to regard tax obligations as among the least pressing rather than as the most pressing obligations of all.

Necessity of a Stricter Arrears Policy.—When a Province is able to collect scarcely one-half of its tax levy within the legal period the time has come to adopt stringent measures. It is strongly recommended that the Government take a firm stand in favour of regular tax sales. Without the stimulus applied in this manner the present very serious situation will probably grow progressively worse.

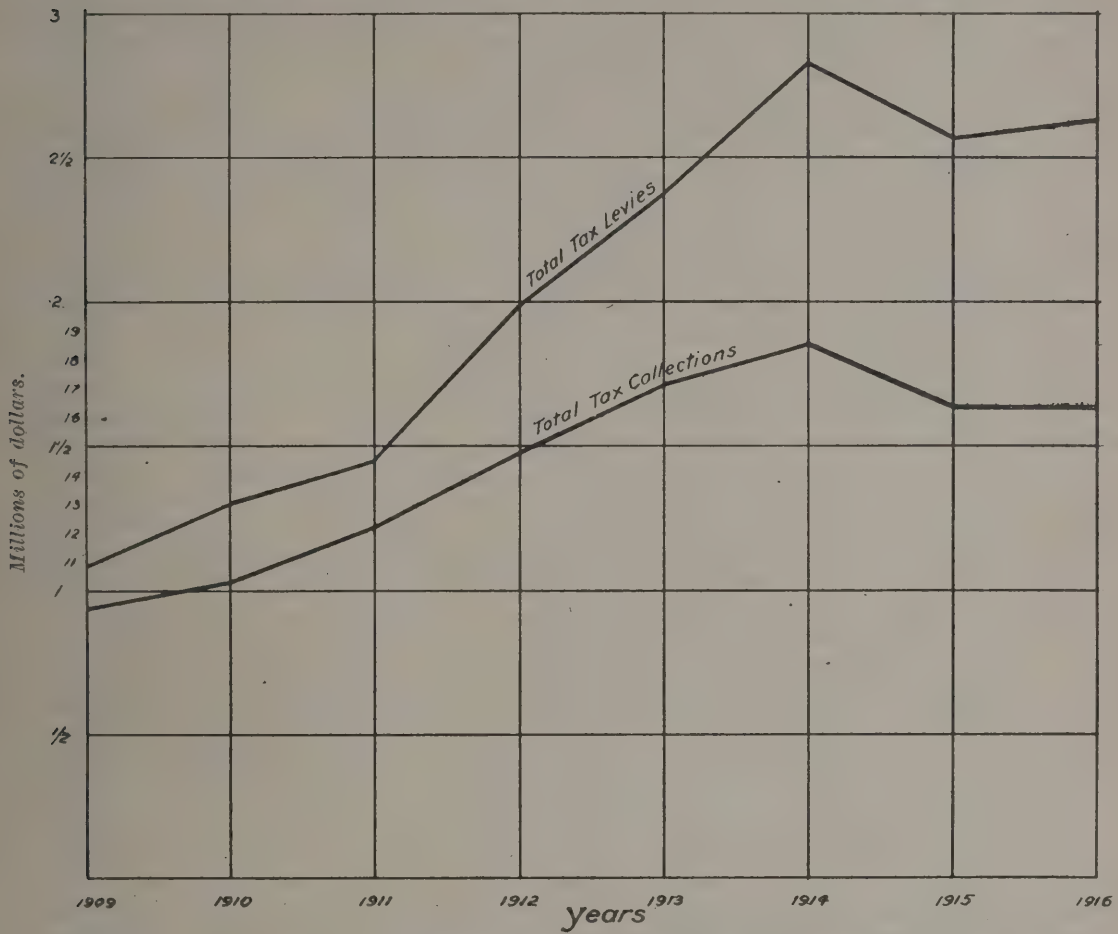
The adoption of a more stringent arrears policy may involve the necessity of making special concessions to certain classes in the community who are handicapped because of the war, particularly soldiers and their dependents.

Realizing on Arrears.—Too great expectations cannot be based upon the returns to be realized as the result of the adoption of a stricter arrears policy. The entire three and two-thirds millions of unpaid taxes cannot be collected by the mere decision to hold tax sales. In fact, a very considerable portion of this sum, amounting, as nearly as can be estimated, to about $1,500,000,* is placed in a very peculiar position through the passage of the "Soldiers' Homestead Act." Anything which is realized upon this sum will appear as receipts of the Lands Depart-

* On September 30th, 1916, the arrears of taxes on wild lands, held on the basis of certificates of purchase, amounted to $1,410,223.10.

Graph XI.—Comparison of Levies with Collections for Fiscal Years, 1909-16.

(Taxes on Improved Realty, Wild, Coal and Timber Lands, Personal Property, and Income.)



ment rather than as taxes. Nevertheless, it is only reasonable to anticipate the realization of a very considerable sum if a stand is taken which will show that the Government expects to hold taxpayers strictly accountable for their obligations.

Payment of Taxes as a Condition to passing Title.—As a measure to assist in the collection of taxes it would be wise to impose a requirement, similar to one already in force in the municipalities, to the effect that all taxes must be paid upon a parcel of realty before title can be passed.

The Discount for Prompt Payment.—A discount of 10 per cent. is allowed upon taxes on real and personal property, income, and on wild, coal, and timber land* in order to encourage the prompt payment of taxes. The plan appears to be measurably successful in attaining this object, for the bulk of the taxes are paid before June 30th. The question remains, however, as to whether the discount is an economical device. It has been in force so long that data are not available showing the effect upon promptness brought about by its imposition. Its justification must rest upon the result of comparing its cost with the cost of the alternative plans of borrowing temporarily to meet current expenditures, if that should be necessary.† The Government really pays 10 per cent. for the use of the money for six months, assuming that the money would be paid, anyway, at the end of the year. It could probably borrow at the rate of 5 per cent. per

* No discount is allowed on the mineral-tax, which is payable quarterly.

† As a matter of fact, it would undoubtedly be necessary under normal conditions, for the heavy expenditures from the Treasury are made in the summer months.

annum to meet expenses during those six months. It is estimated that the total discounts allowed annually amount to approximately $150,000.

The granting of so substantial a discount, moreover, has an undesirable effect upon the taxpayer, in that it has a tendency to make him regard his tax charge as an unfairly large sum which he can expect to be reduced before payment.

Perhaps the strongest justification which can be urged in favour of the discount plan is not valid in this case, for the discount cannot here be considered a bonus for the advance payment of taxes. The taxes are due on January 2nd of each year, and the discount is very frankly not a recompense, but a bait.

It would appear to be a policy worthy of a trial, at least, to make taxes due April 1st rather than January 2nd, and receivable at par before the end of June, abolishing the discount, at which date they would pass into arrears and be subject to a substantial penalty.

The advantages of this plan would be: (1) It would make it possible to include on the tax notice sent to the property-owner an accurate statement of actual arrears outstanding against him on January 1st; (2) it would cause the receipts for the current year's taxes to come into the Treasury after the opening of the fiscal year, thus eliminating much of the present confusion; (3) it would tend to give a greater degree of definiteness to the tax notice, which would then be a demand to pay the full amount within three months upon pain of a penalty, in place of a notice which can be ignored without penalty for more than a year, or which can be discounted below the amount charged on its face by payment within a period of more than six months; and (4) if the plan were successful in securing the payment of as much of the tax levy before June 30th as is now the case, there would be a clear saving to the Province of the discount of 10 per cent., which amounts to a very substantial sum.

The Tax-collection Period.—The period during which the taxes are payable (twelve months) is unnecessarily long. Notices sent out before the first of the year in many cases become lost before June 30th, the date when the discount privilege of 10 per cent. expires, giving rise to many requests for duplicate bills.

Moreover, on the notices sent out before January 1st the taxes of the current year remaining unpaid at the date the notice is mailed are listed as in arrears, even though they are not in arrears until December 31st. This can scarcely have other than an unfortunate effect, for it amounts to a notice that the taxes which a person was asked to pay a full year previously may still be paid before December 31st without penalty, and a reminder that the new taxes may be allowed to drift more than a year without involving him in any embarrassment.

Penalties.—The present penalties provided in the case of unpaid taxes, if, indeed, the interest charge of 6 per cent. per annum can be construed as a penalty at all, are grotesquely inadequate to the task of forcing the payment of taxes. Indeed, the existing arrangement may be said rather to encourage the non-payment of taxes after once the discount period has elapsed, for 6 per cent. is lower than the rate of interest the property-owner would be compelled to pay were he to borrow money to meet his taxes. It is really economically wise to permit the Government to finance him.

The penalty should be made at least 10 per cent. if it is to be expected to provide any compelling force in the direction of tax payments. In fact, a rate of 1 per cent. per month would, under the circumstances, probably not be too high a rate.

Minimum Taxes.—The subdivision into small parcels of lands which have a very low value and the distribution of the parcels among various owners have raised a serious administrative problem in the expense attached to the taxation of the lots. The cost of the labour of assessing, of making records, of sending notices, etc., in the case of many parcels is more than the amount of the tax involved. Most often is this true in the case of school lands where no fixed minimum is imposed. In the case of Provincial taxes there is a low minimum, the amount of the tax, if less than 25 cents, being increased to that amount. It is asserted, however, that 25 cents is not a sufficiently high charge. Certainly there is no justification for the continuance of a tax which yields less than it costs to administer. Such a tax is a ridiculous failure. Far better to leave the money in the hands of the property-owner than to burn it up as fuel for the administrative machine which accomplishes nothing more than to take the money from him.

The situation would be measurably relieved by making the tax base for school purposes identical with certain elements of the tax base used for Provincial purposes—e.g., improved land

only or all land (improved, wild, coal, and timber).* This would reduce considerably the present administrative expense. In addition, the minimum should be made sufficiently high to cover this expense, $1 being suggested by the administrative officials as a proper amount.

Reports of Collections.—To make possible a more intelligent control of the financial situation, the records should be so changed as to permit the preparation of frequent statements for the Minister of Finance, (1) comparing collections with specific levies, and (2) comparing arrears for significant periods. The books of the Province are now so kept that only the cash collections are recorded. Whatever the advantages of this policy may be from other points of view, it certainly does not give the administrator a perfect picture of the degree of success attained in collecting taxes. The only information available from the Public Accounts is the statement of the cash receipts from the various taxes. The figure given is a resultant obtained by including the receipts from the current year's levy (discounts having been allowed in some cases and not allowed in others), the receipts from previous years' levies which have been carried into arrears, and the receipts from the succeeding year's levy to the extent that they are paid during the first two months of the year. This figure may be compared with the same figure for the preceding year, but, with variations in assessments and rates, conclusions from such comparisons are almost worthless.

It would be possible, however, at a trifling addition of bother and expense, to furnish a monthly statement of the exact status of collections. The tax rolls now are summarized in such a fashion as to show the total taxes supposed to be collected by each Collector. These amounts could be definitely debited to each Collector and the moneys collected by him definitely credited to him. The form of the Collector's return would necessarily be made somewhat different in order to show more precisely the year's levy to which the amount collected belongs and the discounts allowed. By tabulating these returns and comparing them with levies an exact and dependable report could be quickly prepared.†

CONCLUSIONS.

The most important of the suggestions and conclusions scattered through the text may be summarized as follows:—

THE PRESENT FINANCIAL DIFFICULTIES ARE NOT DUE TO A SUDDEN BREAK-DOWN IN THE TAX SYSTEM.

The stringency now being experienced is due primarily to the forces which have weakened the demand for real estate. The yield of the tax system has declined somewhat, but this is because of the disappearance of the receipts under the "Chinese Restriction Act." The slump in the receipts from land-sales and from fees dependent upon such sales is the fundamental cause of the present embarrassment.

IT IS UNWISE TO EXPAND TAXATION TO MAKE GOOD THE ENTIRE DIFFERENCES BETWEEN THE RECEIPTS OF THE MOST PROSPEROUS YEARS AND THE YEARS OF DEPRESSION.

If the scale of expenditure is maintained on the level of the total receipts of the most prosperous years and taxation depended upon to supply the deficiencies caused by the slump in other sources of revenue, the result will be a strain upon the tax system probably too great to be borne. In the present instance, for example, this policy would involve trebling the tax rates at a time when the taxpayers are least able to assume new burdens. It is essential that a rational control be exercised over expenditure in periods of prosperity which will make unnecessary excessive taxation in times of depression. The adoption of such a policy would prevent the periodical recurrence of the present difficulty.

THE EXISTING TAX SYSTEM IS UNEQUAL TO THE DEMANDS OF THE PRESENT SITUATION.

It is unreasonable to expect the tax system in its present form to provide the funds which are necessary by the simple device of increasing rates. The crudeness of the taxes, which passes unnoticed when burdens are small, involves intolerable injustices when the burdens become large. Administrative shortcomings which are insignificant when rates are low become fatal when rates are increased to the levels which obtain as the result of the readjustment of 1917.

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* *Cf. supra,* page 117.

† It would be noted that this does not involve a change in the general system of accounts or the introduction of the item of "unpaid taxes" as an asset on the Provincial balance-sheet.

THE TAX SYSTEM SHOULD BE THOROUGHLY REORGANIZED BOTH IN RELATION TO KINDS OF TAXES IMPOSED AND IN RELATION TO ADMINISTRATION.

Both equity and financial considerations demand thoroughgoing tax reform in the Province. The taxes now in existence constitute a complicated medley which can scarcely be dignified by the term "system." Certain taxes should be entirely eliminated and the others should be recast and merged into a coherent revenue system.

The administrative machinery, which has stood unaltered for fifteen years, should be modernized and made efficient.

THE RATES ON WILD LANDS MUST BE MODIFIED IF THIS TAX IS TO BE PRESERVED AS A SOURCE OF REVENUE.

The tax on wild lands, the most important fiscally of the taxes on real estate, appears to be on the verge of collapse, the statistics of arrears revealing a most serious situation. If the Province desires to use this tax as a source of revenue and does not desire to confiscate the lands, the rates must apparently be lowered considerably.

A THOROUGH INVESTIGATION SHOULD BE MADE WITH A VIEW TO READJUSTING THE TAX BURDEN ON AGRICULTURE AND ON MINING, TIMBER, AND CANNING INDUSTRIES.

Data should be secured which would make it possible to draw sound conclusions regarding the relative burdens now being imposed upon the various industries. The variety and nature of the various charges preclude comparisons, and without an investigation no scientific reorganization is possible. There is ample evidence that such a reorganization is needed.

THE POLL-TAX, AMUSEMENT-TAX, AND THE PERSONAL-PROPERTY TAX SHOULD BE SLATED FOR REPEAL AT THE EARLIEST PRACTICABLE MOMENT.

These are the least justifiable of the taxes now in force and their elimination would not involve great financial loss. So soon as it becomes apparent that the yield from these sources can be dispensed with, these taxes should be repealed.

THE INCOME-TAX SHOULD BE REFORMED BY REDEFINING THE DEFINITION OF INCOME AND REARRANGING THE SCALE OF RATES.

The present income-tax law should be radically amended by redefining income in accordance with the detailed suggestions detailed in the body of the report, and by modifying the rates so as to make them more uniform and, if financially possible, more moderate.

THE VARIOUS CHARGES ON MOTOR-VEHICLES SHOULD BE CONSOLIDATED.

At present the variety and number of separate taxes levied on motor-vehicles involve needless expense to the administrator and needless inconvenience to the owner.

BANKS, RAILWAYS, AND SERVICE CORPORATIONS SHOULD BE TAXED IN A MANNER WHICH MEASURES MORE ACCURATELY RELATIVE TAX-PAYING ABILITY.

The present levies on these types of property are so undiscriminating as to involve substantial injustices as between different units.

A PERMANENT TAX BOARD WITH WIDE POWERS SHOULD BE PLACED AT THE HEAD OF THE TAX SYSTEM.

The proper administration of the revenue system demands a more elaborate organization than has been used heretofore. It is recommended that a permanent Board of power, dignity, and responsibility be created to assume direction of the tax machinery. This Board as its first duty should reorganize the assessment districts and build up an efficient force of Assessors.

A STRICT POLICY WITH RESPECT TO COLLECTIONS SHOULD BE ADOPTED.

The present lenient arrears policy has demoralized collections. Until a firm and businesslike stand is taken on this question, a satisfactory solution of the financial problem of the Province cannot be hoped for.

APPENDICES.

APPENDIX A.

THE CLASSIFICATION OF REVENUES.

The receipts of the Province are presented in the Public Accounts in three tables. The first is a "Comparative Statement of the Receipts and Expenditures," which presents in parallel columns the data for a period of years. The second table is an itemized statement of the large amount entered in the general table under the head of "Miscellaneous Receipts." The third table, "Revenue for the Fiscal Year," gives the current year's collections by districts. The figures in all cases represent cash receipts.

Even though the general accounting procedure of the Province is not so changed as to bring to account total levies instead of merely cash receipts, the form of the tables dealing with revenues could be changed to good advantage. As now presented the data are often unintelligible.* There is need for more detail in some directions and for less in others. The titles of some of the receipts are almost entirely "blind," carrying no meaning at all except to the initiated few. Finally, no attempt is made at classification. Receipts of all types—taxes, fees, rents, sales, subsidies—important and trivial in amount, are thrown together in a heterogeneous jumble. The use of the data for drawing conclusions of any sort must consequently be preceded by an interpretation, an analysis, and a classification which involve time and labour. There is no good reason why some scheme of classification should not be adopted which would make it possible to grasp the significance of the figures without involving a prohibitive amount of effort.

The particular classification which should be adopted depends upon the points it is most desirable to make clear. Thus the classification might be designed to show the portion of the revenues contributed by individuals as compared with various specified business interests; or it might show relative burdens of the organized and unorganized areas of the Province; or the revenues which are fixed as compared with those which are relatively flexible; or the revenues which are stable and dependable as compared with those which are variable and unreliable, etc.

The classification adopted for the purposes of this study and which is utilized in the construction of Table I.† has several points to commend it. In the first place, it recognizes the established categories of public finance, grouping the receipts according to their nature, as subsidies, income from the public domain, fees, and taxes. Second, it brings out clearly the significance of the public domain in the finances of the Province. Third, it assists the user of the table by labelling according to their nature the many indefinite and unclear items. Finally, it can be adopted with but minor changes in the present Provincial records and without destroying the comparability of the statistics for previous years. The classification is presented as a tentative one in the belief that some modification of it will prove satisfactory under the conditions obtaining in British Columbia.

The principles of the suggested classification are apparent for the most part from an inspection of the table. The second item includes the receipts from the sale or lease of public property or from royalties upon certain articles in which the public interest is held to be particularly strong—e.g., the forests, the mineral deposits, and the fisheries. The fees are payments for special services performed by the State and are distinguished from taxes by the fact that in general they approximate the cost of service rendered and are not imposed primarily to secure net revenue.

Naturally there are cases where there exists some doubt about the group to which the receipt belongs. Thus it is difficult to decide whether the receipts under the "Motor-traffic Regulation Act" are more truly fees than taxes, and whether registry fees are not more properly taxes rather than fees.

* The investigator found that the statements could not be completely interpreted by a number of persons who were concerned with the actual administration of the financial system.

† *Cf. supra*, pages 82-3.

To make an accurate classification of receipts under the plan outlined it is necessary that the canneries and whaling tax be segregated from the personal-property item. Moreover, it is desirable, though not imperative, that a separate statement be made of the receipts from: (1) The tax on railways; (2) the tax on banks; (3) the tax on the gross income of certain companies; (4) the tax on improved real estate; (5) the tax on coal lands, Class A; (6) the tax on coal lands, Class B; (7) the tax on timber lands; (8) the tax on wild lands; (9) timber licences; and (10) timber leases.* To conform with usual practice the "revenue-tax" should be rechristened the "poll-tax."

Within the classes the receipts should be arranged alphabetically. The large miscellaneous item, which appears to consist principally of fees, might be distributed among the classes.

APPENDIX B.

INCOME-TAX RATES.

The combined tax burden under the new Federal income-tax law and the increased Provincial income-tax rates is worked out in detail in Table A and illustrated by Graph A. The table shows the amounts of each tax payable by persons receiving various typical incomes and the true combined rate on the total income.† The graph reveals marked irregularities in the present progression which are particularly serious in the case of the lower incomes as shown in the graph inserted in the lower corner. The data include no incomes above $150,000. The rates on the higher incomes increase gradually and regularly until they approximate in the case of individuals 39 per cent.

To reduce the irregularity shown by this curve and still to maintain the present productivity of the tax, this report recommends certain changes in the rates.‡ It also recommends alterations in the initial exemptions.§ Table B and Graph B show the effects of these proposed changes upon the lower incomes. A progression considerably more even and regular is effected in all cases. The small corporations, because of the elimination of the initial exemption, would be subject to a perceptibly higher rate. Single men pay slightly more than before and married men with dependents slightly less.

Graph C compares the rates for single men with incomes ranging up to $150,000 under the recommended rates and exemptions. Table C supplies the underlying data for the graph. The change in rates, it is apparent, eliminates much of the irregularity now present in the taxation of incomes ranging from $10,000 to $25,000.

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* These receipts are now included in other items. Somewhere, if not in the general statement of receipts, there should be summarized a statement of the income-tax by classes of income affected.

† Including initial exemptions. The assumption is made that the definition of taxable income in the two laws is identical.

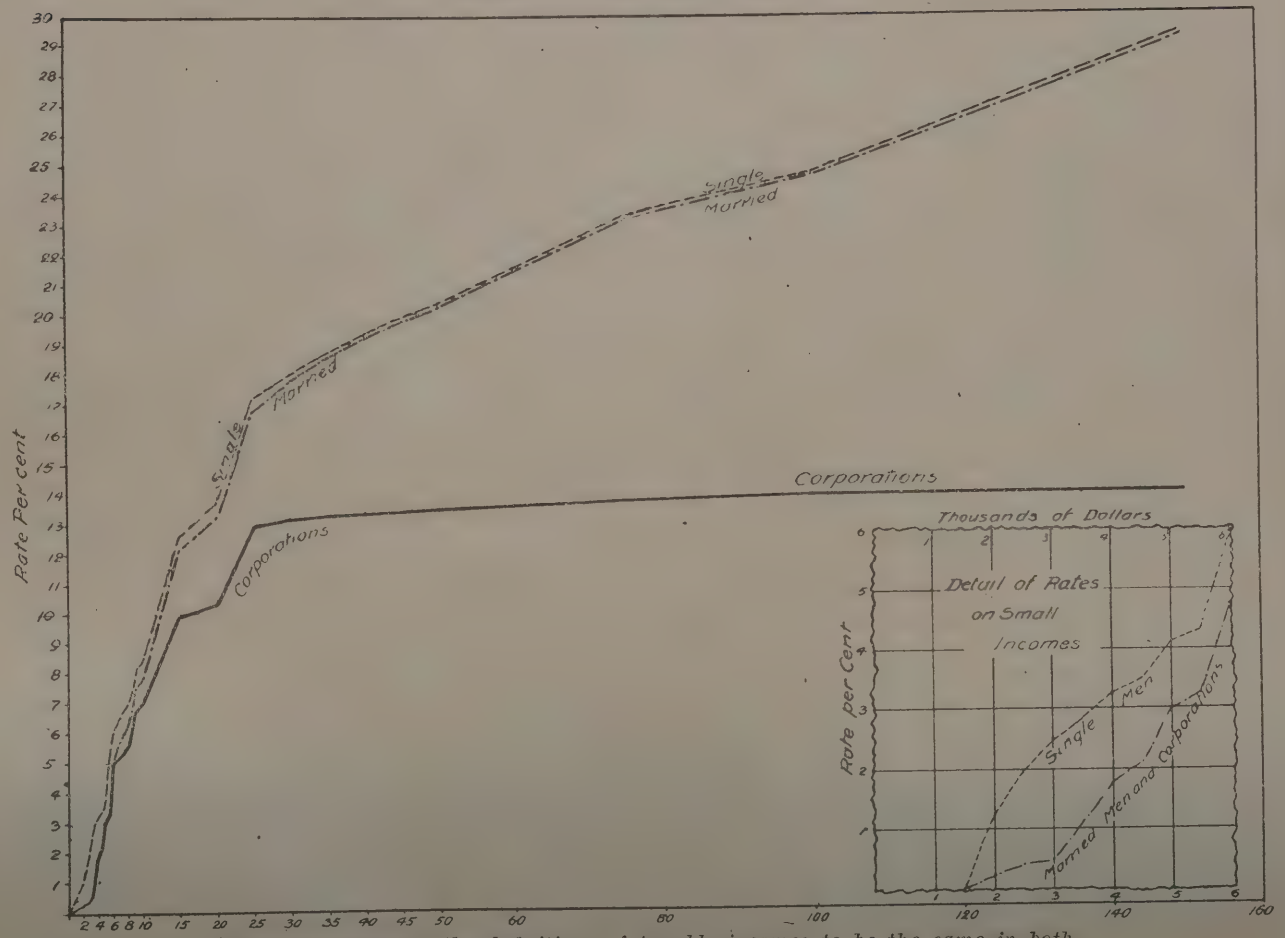
‡ *Cf. supra,* page 105.

§ *Cf. supra,* pages 105-6.

Table A.—Taxes payable and Tax Rates under the Dominion and Provincial Income-taxes (Total Income includes the Initial Exemptions).

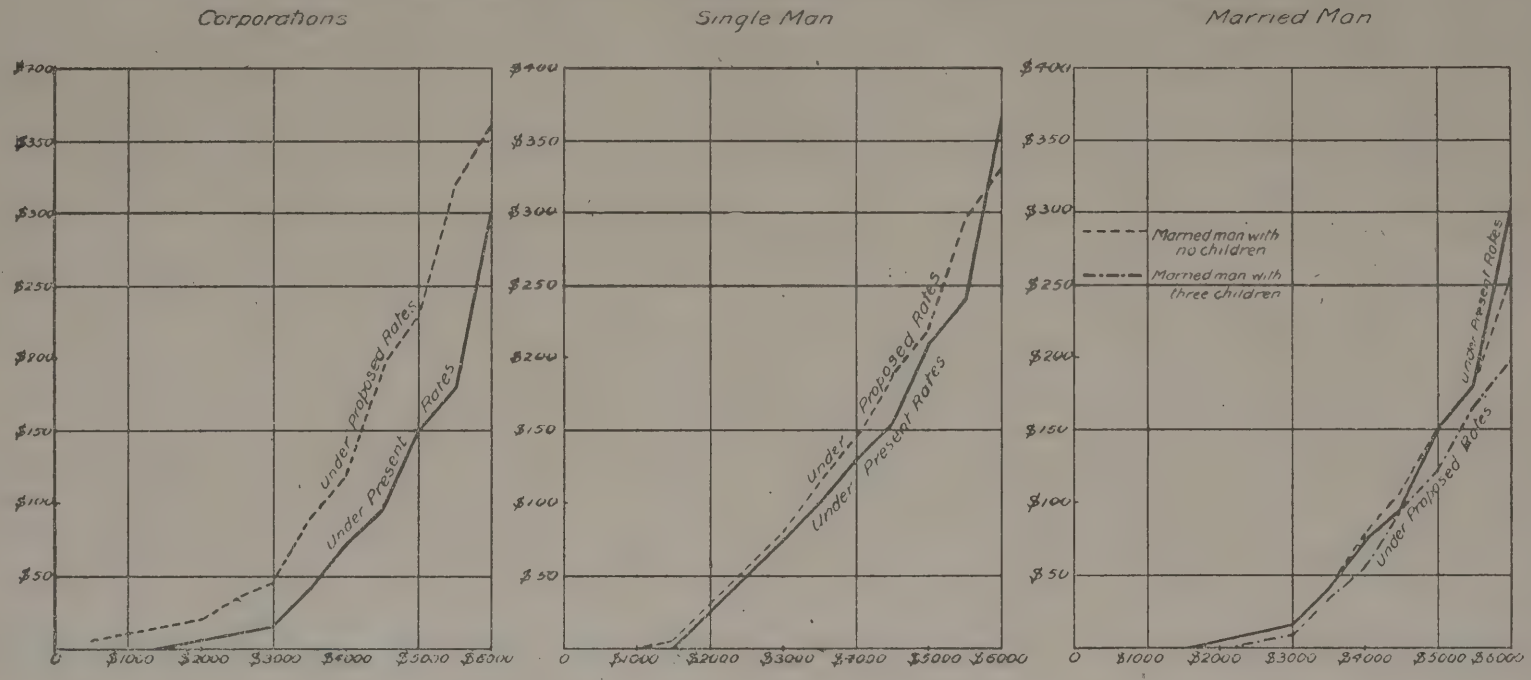
Total Income.	Single Men.				Married Men.				Corporations.			
	Dominion.	Provincial.	Total.	Rate per Cent.	Dominion.	Provincial.	Total.	Rate per Cent.	Dominion.	Provincial.	Total.	Rate per Cent.
$ 1,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,000	$ 20 00	$ 5 00	$ 25 00	$ 1.25	.....	$ 5 00	$ 5 00	0.25	.....	$ 5 00	$ 5 00	0.25
2,500	40 00	10 00	50 00	2.0	.....	10 00	10 00	0.4	.....	10 00	10 00	0.4
3,000	60 00	15 00	75 00	2.5	.....	15 00	15 00	0.5	.....	15 00	15 00	0.5
3,500	80 00	20 00	100 00	2.85	$ 20 00	20 00	40 00	1.15	$ 20 00	20 00	40 00	1.15
4,000	100 00	31.25	131 25	3.28	40 00	31 25	71 25	1.78	40 00	31 25	71 25	1.78
4,500	120 00	37 50	157 50	3.5	60 00	37 50	97 50	2.17	60 00	37 50	97 50	2.17
5,000	140 00	70 00	210 00	4.2	80 00	70 00	150 00	3.0	80 00	70 00	150 00	3.0
5,500	160 00	80 00	240 00	4.36	100 00	80 00	180 00	3.27	100 00	80 00	180 00	3.27
6,000	180 00	180 00	360 00	6.0	120 00	180 00	300 00	5.0	120 00	180 00	300 00	5.0
7,000	240 00	220 00	460 00	6.57	180 00	220 00	400 00	5.71	160 00	220 00	380 00	5.43
8,000	300 00	260 00	560 00	7.0	240 00	260 00	500 00	6.25	200 00	260 00	460 00	5.75
9,000	360 00	375 00	735 00	8.17	300 00	375 00	675 00	7.5	240 00	375 00	615 00	6.83
10,000	420 00	425 00	845 00	8.45	360 00	425 00	785 00	7.85	280 00	425 00	705 00	7.05
15,000	870 00	1,012 50	1,882 50	12.55	810 00	1,012 50	1,822 20	12.15	480 00	1,012 50	1,492 50	9.95
20,000	1,320 00	1,387 50	2,707 50	13.54	1,260 00	1,387 50	2,647 50	13.23	680 00	1,387 50	2,067 50	10.33
25,000	1,920 00	2,350 00	4,270 00	17.08	1,860 00	2,350 00	4,210 00	16.84	880 00	2,350 00	3,230 00	12.92
30,000	2,520 00	2,850 00	5,370 00	17.90	2,460 00	2,850 00	5,310 00	17.70	1,080 00	2,850 00	3,930 00	13.1
35,000	3,220 00	3,350 00	6,570 00	18.8	3,160 00	3,350 00	6,510 00	18.6	1,280 00	3,350 00	4,630 00	13.23
40,000	3,920 00	3,850 00	7,770 00	19.42	3,860 00	3,850 00	7,710 00	19.28	1,480 00	3,850 00	5,330 00	13.33
45,000	4,620 00	4,350 00	8,970 00	19.93	4,560 00	4,350 00	8,910 00	19 80	1,680 00	4,350 00	6,030 00	13.40
50,000	5,320 00	4,850 00	10,170 00	20.3	5,260 00	4,850 00	10,110 00	20.22	1,880 00	4,850 00	6,730 00	13.46
75,000	10,070 00	7,350 00	17,420 00	23.23	10,010 00	7,350 00	17,360 00	23.15	2,880 00	7,350 00	10,230 00	13.64
100,000	14,820 00	9,850 00	24,670 00	24.67	14,760 00	9,850 00	24,610 00	24.61	3,920 00	9,850 00	13,770 00	13.77
150,000	29,320 00	14,850 00	44,170 00	29.45	29,260 00	14,850 00	44,110 00	29.41	5,880 00	14,850 00	20,730 00	13.81

Graph A.—Combined Dominion and Provincial Income-tax Rates. (Total Incomes include the Initial Exemptions.)



* *This chart assumes the definitions of taxable incomes to be the same in both Dominion and Provincial laws.*

Graph B.—Amount of Total Taxes payable under Present Dominion and Provincial Income-tax Rates contrasted with those payable if the Proposed Changes in the Provincial Rates and Initial Exemptions are adopted.



Group C.—Rates of Total Taxes payable by Single Men under Dominion and Provincial Income-tax Rates, assuming the Proposed Changes in the Provincial Rates and Initial Exemptions are adopted.

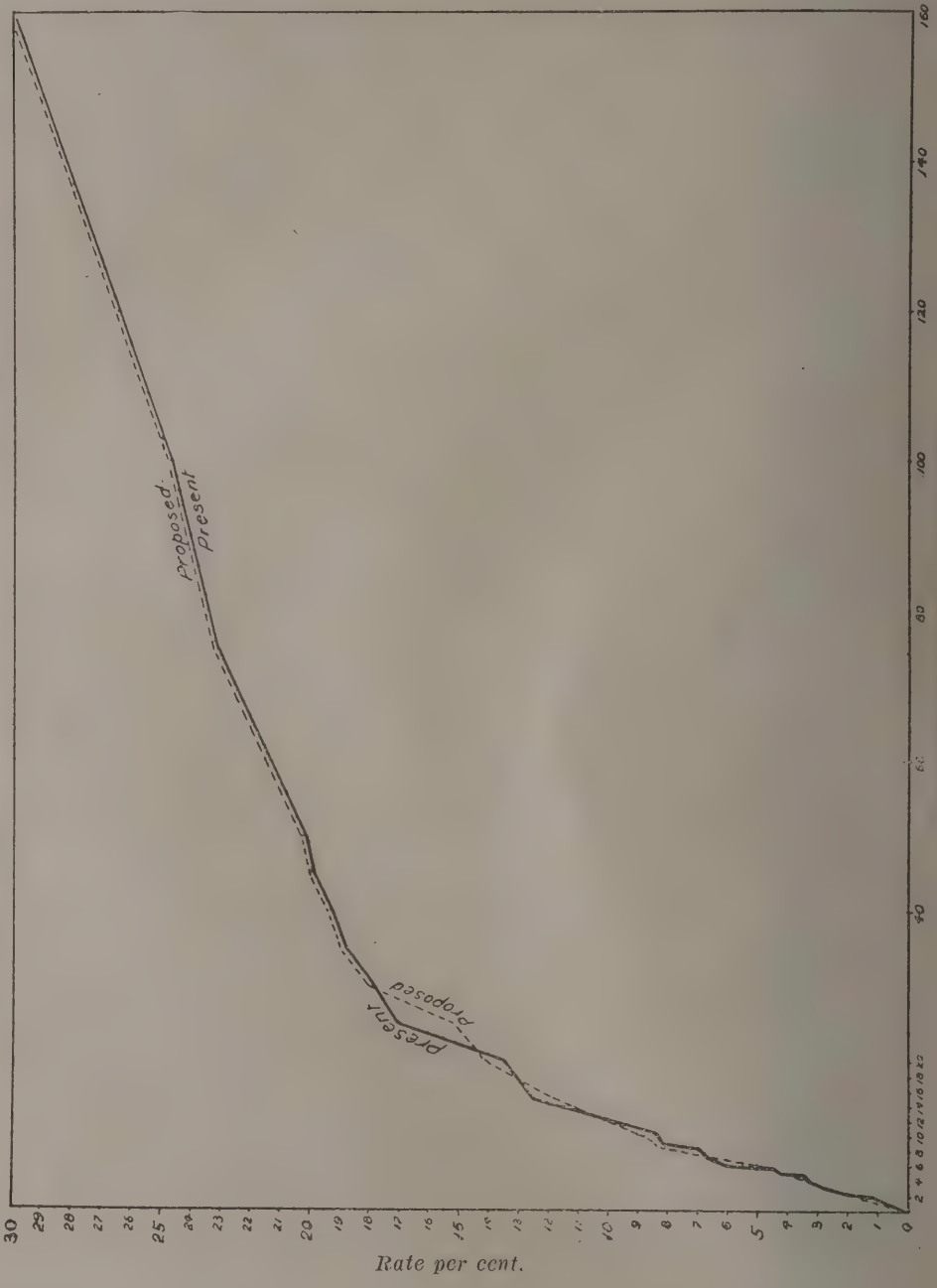


Table B.—Amount of Total Taxes payable under Dominion and Provincial Income-tax Rates, assuming the Proposed Changes in Provincial Rates and Initial Exemptions are adopted.

Total Income.	Single Men.			Married Men without Children.			Married Men with Three Children.			Corporations.		Total.
	Dominion.	Provincial.	Total.	Dominion.	Provincial.	Total.	Dominion.	Provincial.	Total.	Dominion.	Provincial.	
$1,500	.....	$ 5 00	$ 5 00	.....	.....	.....	.....	.....	.....	.....	$ 5 00	$ 15 00
2,000	$ 20 00	10 00	30 00	.....	$ 5 00	$ 5 00	.....	.....	.....	.....	20 00	20 00
2,500	40 00	15 00	55 00	.....	10 00	10 00	.....	$ 4 00	$ 4 00	.....	37 50	37 50
3,000	60 00	20 00	60 00	.....	15 00	15 00	.....	9 00	9 00	.....	45 00	45 00
3,500	80 00	37 50	117 50	$ 20 00	20 00	40 00	$ 20 00	14 00	34 00	$ 20 00	70 00	90 00
4,000	100 00	45 00	145 00	40 00	37 50	77 50	40 00	19 00	59 00	40 00	80 00	120 00
4,500	120 00	70 00	190 00	60 00	45 00	105 00	60 00	36 00	96 00	60 00	135 00	195 00
5,000	140 00	80 00	220 00	80 00	70 00	150 00	80 00	43 50	123 50	80 00	150 00	230 00
5,500	160 00	135 00	295 00	100 00	80 00	180 00	100 00	68 00	168 00	100 00	220 00	320 00
6,000	180 00	150 00	330 00	120 00	135 00	255 00	120 00	78 00	198 00	120 00	240 00	360 00

Table C.—Taxes payable and Tax Rates under the Dominion and Provincial Income-taxes in the Case of Single Men.

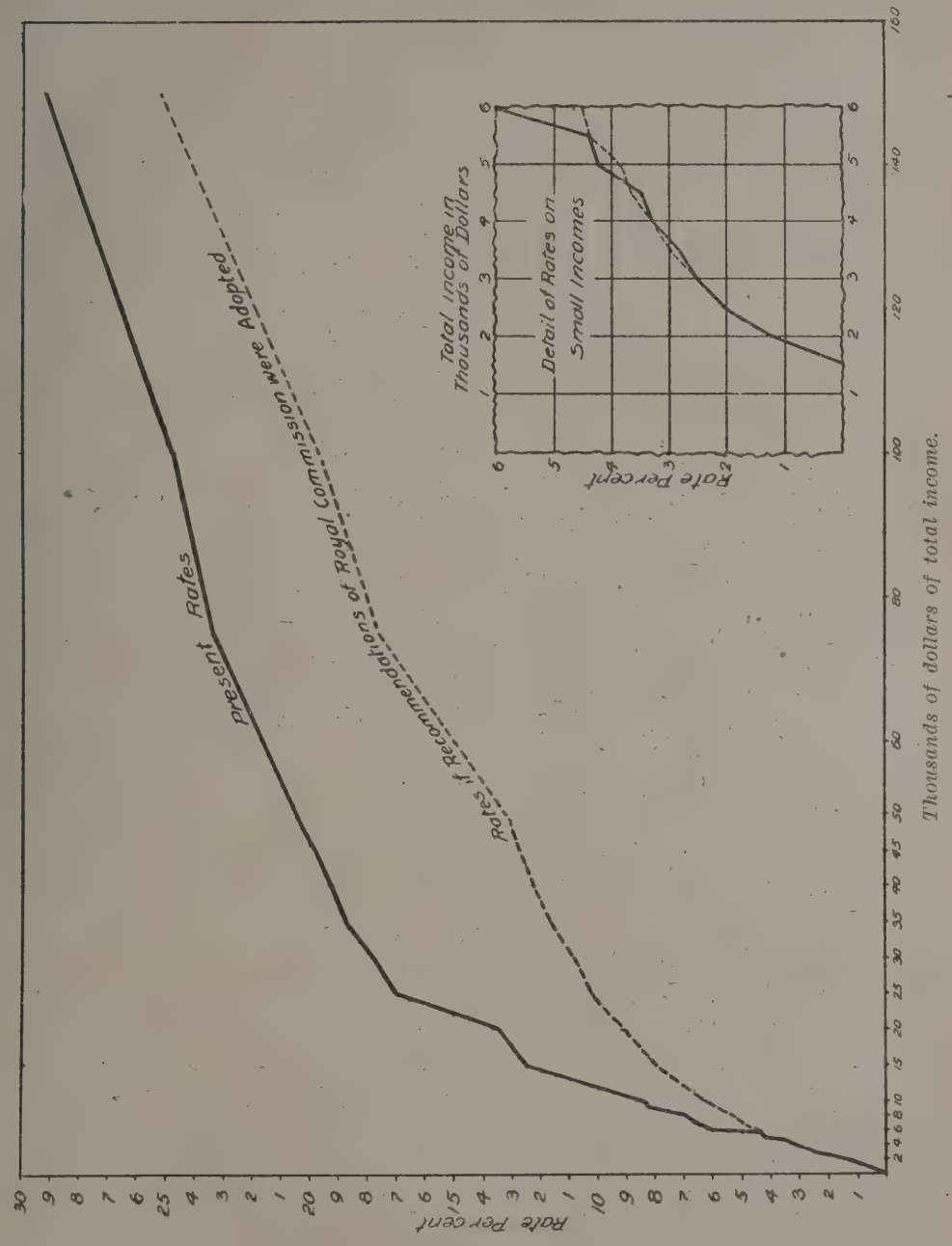
Total Income.	Amount of Dominion Tax.	Amount of Provincial Tax.	Total Amount.	Total Rate.
				Per Cent.
$ 1,500	.....	$ 5 00	$ 5 00	0.33
2,000	$ 20 00	10.00	30 00	1.5
2,500	40 00	15 00	55 00	2.2
3,000	60 00	20 00	80 00	2.66
3,500	80 00	37 50	117 50	3.36
4,000	100 00	45 00	145 00	3.62
4,500	120 00	70 00	190 00	4.22
5,000	140 00	80 00	220 00	4.4
5,500	160 00	135 00	295 00	5.36
6,000	180 00	150 00	330.00	5.5
7,000	240 00	240 00	480 00	6.86
8,000	300 00	280 00	580 00	7.25
9,000	360 00	400 00	760 00	8.44
10,000	420 00	450 00	870 00	8.70
15,000	870 00	910 00	1,780 00	11.87
20,000	1,320 00	1,520 00	2,840 00	14.2
25,000	1,920 00	1,920 00	3,840 00	15.36
30,000	2,520 00	2,900 00	5,420 00	18.07
35,000	3,220 00	3,400 00	6,620 00	18.91
40,000	3,920 00	3,900 00	7,820 00	19.55
45,000	4,620 00	4,400 00	9,020 00	20.04
50,000	5,320 00	4,900 00	10,220 00	20.44
75,000	10,070 00	7,400 00	17,470 00	23.29
100,000	14,820 00	9,900 00	24,720 00	24.72
150,000	29,320 00	14,900 00	44,220 00	29.48

The recommendations of the Royal Commission on Taxation of 1911 in regard to changes in the income-tax rates are given above. The amounts which would be payable by single persons receiving various incomes are shown in Table D, where they are also combined with the amounts payable under the Federal income-tax law and the total rates on the entire income is calculated. Graph D contrasts these rates with the rates now obtaining. The adoption of the rates recommended by the Commission would result in a fairly regular and even progression, but the rates on the whole are substantially lower than the present scale. The adoption of the recommendation of the Vancouver Board of Trade, that the surtax not apply to corporate incomes, would reduce the productivity of the tax still more.

Table D.—Taxes payable and Tax Rates under the Dominion and Provincial Income-taxes applying to Single Men in Case the Recommendations of the Royal Commission on Taxation are adopted.

Total Income.	Dominion.	Provincial.	Total.	Percentage.
$ 1,500	.....	.....	.....	.....
2,000	$ 20 00	$ 5 00	$ 25 00	1.25
2,500	40 00	10 00	50 00	2.0
3,000	60 00	15 00	75 00	2.5
3,500	80 00	25 00	105 00	3.0
4,000	100 00	31 25	131 25	3.28
4,500	120 00	45 00	165 00	3.66
5,000	140 00	52 50	192 50	3.85
5,500	160 00	80 00	240 00	4 36
6,000	180 00	90 00	270 00	4.5
7,000	240 00	110 00	350 00	5.0
8,000	300 00	130 00	430 00	5.37
9,000	360 00	187 50	547 50	6.08
10,000	420 00	212 50	632 50	6.32
15,000	870 00	375 00	1,245 00	8.03
20,000	1,320 00	500 00	1,820 00	9.1
25,000	1,920 00	625 00	2,545 00	10.18
30,000	2,520 00	750 00	3,270 00	10.90
35,000	3,220 00	875 00	4,095 00	11.70
40,000	3,920 00	1,000 00	4,920 00	12.30
45,000	4,620 00	1,125 00	5,745 00	12.74
50,000	5,320 00	1,250 00	6,570 00	13.14
175,000	10,070 00	3,125 00	13,195 00	17.59
100,000	14,820 00	5,000 00	19,820 00	19.82
50,000	29,320 00	8,750 00	38,070 00	25.38

Graph D.—Combined Dominion and Provincial Income-tax Rates. Present Rates compared with Rates which would obtain if the Recommendations of the Royal Commission were adopted. (Total Incomes include the Initial Exemptions.)


Present Rates
Rates if Recommendations of Royal Commission were Adopted
Rate Per cent
Thousands of dollars of total income.
Detail of Rates on Small Incomes
Total Income in Thousands of Dollars
Rate Per cent

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

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PROVINCE OF BRITISH COLUMBIA

ANNUAL REPORT

OF

THE DEPARTMENT OF RAILWAYS

FOR THE

YEAR ENDING DECEMBER 31ST

1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

To His Honour Sir Frank Stillman Barnard, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

May it please Your Honour:

Herewith I beg respectfully to submit Report for the Department of Railways for the year 1918.

JOHN OLIVER,
Minister of Railways.

Victoria, B.C., February 14th, 1919.

REPORT OF DEPARTMENT OF RAILWAYS.

Hon. John Oliver,
Minister of Railways, Victoria, B.C.

Victoria, B.C., December 31st, 1918.

Sir,—I have the honour to submit a report dealing with the principal activities of the Railway Department during the year ending December 31st, 1918.

The staff of the Department consists of Chief Engineer, Assistant Engineer, Inspector of Rolling-stock and Equipment, clerk, and stenographer.

In addition to railways proper, the Department has control over the Songhees terminal improvement-works and the maintenance and operation of the combined railway and highway bridge over the Fraser River at New Westminster, with its railway and highway approaches and connections.

An examination of the whole Grand Trunk Pacific line between Yellowhead Pass and Prince Rupert was made in connection with that company's application for right-of-way through Crown lands lying between these points, and all matters in that connection adjusted, except on the section between Miles 30 and 36, west of Yellowhead Pass, where the position with respect to the rights-of-way of the Canadian Northern Railway and the Grand Trunk Pacific is not yet clarified. Right-of-way applications on behalf of other companies, such as the Canadian Northern, V.V. & E., Kettle Valley, and others, have also been dealt with.

Applications for extension of time in which to complete their undertakings made by various railway companies have been dealt with, and certificates of approval have been issued for level, over, and under crossings. Location plans and profiles of various lines of railway and drawings of standard structures were placed before the Minister after examination and received his approval. A list of certificates issued during the year is given in Appendix A.

Canadian Northern Pacific Railway Terminals.

Construction of the terminals of this company has been prosecuted throughout the year, and estimates have been approved for payment in accordance with the provisions of section 7 of the "Canadian Northern Pacific Railway Terminals Act, 1913," as detailed hereunder:—

Estimate No.	41. January	$103,535 24
„	41A. January	28,013 42
„	42. February	58,403 43
„	43. March	47,661 90
„	44. April	95,645 08
„	45. May	43,183 90
„	46. June	24,005 34
„	47. July	54,313 34
„	48. August	62,916 25
„	49. September	23,092 10
„	50. October	24,785 73
„	51. November	16,196 98
„	52. December	21,705 62
	Total	$603,458 33

The position as to the terminals as at December 31st, 1918, is shown by the following statement:—

	Estimated Total Cost of each Terminal.	Proportion of Estimated Cost.	Total Cash Available each Terminal.	Proportion of Total Work now Done.	Amount now earned.	Retentions.	Amount payable.
Vancouver	$4,308,455 10	0.4713	$4,262,363 21	0.70449	$3,002,792 11	$ 3,998 69	$2,998,793 42
New Westminster	2,202,601 50	0.24095	2,179,113 97	0.83633	1,822,458 41	83,507 69	1,738,950 72
Port Mann	1,213,424 62	0.13275	1,200,570 16	0.96341	1,156,641 14	.....	1,156,641 14
Steveston	353,988 89	0.0387	349,996 73	0.8197	286,892 54	.....	286,892 54
Patricia Bay	209,908 29	0.0230	208,008 39	0.9846	204,804 68	.....	204,804 68
Victoria	853,125 00	0.0933	843,790 66	.....	.....	.....	.....
Totals	$9,141,503 40	100,000	$9,043,843 12	.....	$6,473,588 88	$87,506 38	$6,386,082 50

CANADIAN NORTHERN PACIFIC RAILWAY ON VANCOUVER ISLAND.

Track-laying started at the end of October, using rails lent by Pacific Great Eastern Railway Company to Dominion Government, and this work is still proceeding. The tonnage of 60-lb. steel rails turned over to the Canadian Northern Railway at December 31st was as follows: 2,737.8 tons and corresponding amount of accessories.

I may mention that the importance of the Nitinat country as a source of aeroplane-spruce supply was brought first to the attention of the Air Board by the Department in September, 1917. It was the importance of this spruce-supply which brought about the starting-up of this construction-work.

NEW WESTMINSTER BRIDGE.

In addition to the usual maintenance and repair-work carried out during the year to maintain the bridge and its approaches in a high state of efficiency, new 80-lb. steel rails were laid on the tracks leading from the north end of the bridge to the Great Northern line, replacing the old 70-lb. steel rails, which were disposed of by public sale.

An extension of the interlocking system as affecting Great Northern operation was completed at a joint expenditure between that company and the Government, thus assuring a better protection in the handling of railroad traffic across the bridge. This extension makes a positive block between Signal No. 18 on the south end of the bridge and Signal No. 7 in the Great Northern Sapperton plant, a distance of 5,375 feet, and permits only one Great Northern or Canadian Northern train to get within the above-mentioned interlocking section, thereby doing away with the possibility of a head-on or rear collision in the positive-blocked section.

An unsatisfactory condition still, however, exists on the east approach, south end. A Great Northern freight-train may cross the bridge and use the Government approach to get to their old water-front line on the south side of the river for the purpose of picking up or spotting cars at the shingle-mills along this line. This train would be unprotected from the time it passed the home signal on the east approach until it was able to clear the Government track at the switch connecting same with water-front line. The distance between these points is 3,800 feet, and while this unprotected train was in this section it would be possible for a Canadian Northern train to meet it on single track. Negotiations are under way with the Canadian Northern officials to remedy this condition.

A system of soundings was taken around the piers and pier-protection work of the bridge to determine the extent of scour since the previous soundings were taken in 1916. Nothing serious in the way of scour was determined.

No check was taken of the maximum vehicular traffic across the bridge during the year.

The railroad traffic across the bridge for the year 1918 was as follows:—

	Passenger.		Freight.		Mixed.	
	Trains.	Cars.	Trains.	Cars.	Trains.	Cars.
Great Northern Railway	2,261	14,424	860	18,548	1,163	8,535
Canadian Northern Pacific	1,046	5,785	1,178	17,477	1,481	3,039
B.C. Electric Railway	3,051	6,398	1,282	12,140	1,272	3,314*
Canadian Pacific Railway	.....	.....	.....	2,343	.....	.....
Chicago, Milwaukee, & St. Paul	.....	.....	.....	198	.....	.....
Northern Pacific Railway	442	2,452	361	3,968	.....	.....
Totals	6,800	29,059	3,681	54,674	3,916	14,888

* Dairy cars.

SONGHEES TERMINALS.

The work of grading the terminal grounds and industrial sites was carried on during the year up to July 15th, when it was considered advisable to suspend operations until a definite ultimate scheme of development as to terminal facilities was decided on. Sixteen thousand cubic yards of rock-excavation was carried out during the period of work at a cost of $22,000, using the same plant and equipment as in 1917.

A portion of the unimproved area at the west end adjoining Mud Bay and fronting on the harbour, amounting to 3.16 acres, was leased to the Cholberg Ship Company at a rental of $100 per month. This lease expires on February 1st, 1920, and is renewable at the option of the Minister of Railways.

Pacific Great Eastern Railway—Operation.

Operation on this line had been abandoned by the previous management. The line was blocked by snow, ice, and rock slides, and there was not a complete operating, maintenance, or mechanical organization on the road when the Railway Department started on March 13th to get the motive power in shape, so as to open the 167 miles of line between Squamish and Clinton; yet in about three weeks this line was ploughed out, an extra gang, section crew, steam-shovel crew, bridge-repair gang, roundhouse-men, and car-repair men were organized and put to work, and a regular schedule service inaugurated. The main line, Squamish to Clinton, and the North Shore Division, North Vancouver to Whytecliff, were then carefully inspected, and necessary work outside regular maintenance of track and bridge-repair work was undertaken and carried out in the summer months. Ballast was hauled and distributed on sections which had never been raised to final surface, and the line put in good running condition.

The wharf and wharf approach at Squamish was given a thorough overhaul and some needed repairs made at the North Vancouver transfer ferry-slip.

In order to maintain a regular service on the North Shore Division it was decided to replace the pile bridge across the Capilano, which was washed out, by another temporary structure, so as to afford transportation facilities while the two new bridges, 100-foot span each, were being erected. It was estimated that the whole of this work (temporary and permanent bridges) would cost from $48,000 to $50,000. This work was done by contract and has now been completed at the estimated cost.

A new cattle-corral and loading facilities were provided at the Cariboo Road crossing, some thirteen miles north of Clinton, which proved of very great value to the stockmen in the country and benefited the railway company, and thirty additional stock-cars were brought so as to ensure rapid movement of stock shipments.

As the railway company's agreement with the Canadian Pacific Railway Company covering lease of barge handling the traffic between Squamish and Vancouver expired on June 30th, and that any renewal thereafter would have to be on the basis of $50 per day rental instead of the old rate of $40 per day, it was decided to buy or build a barge. Tenders were called for construction of a fifteen-car barge, but no bids were received; consequently most of the barges on the Pacific Coast between San Francisco and Victoria were inquired into with the idea of purchase, and eventually it was found possible to purchase from the Great Northern Railway their transfer barge for $18,000, which had been carefully examined by competent authority and reported on favourably.

On August 7th the tug "Freno," rented by the railway company at $100 per day, was partially destroyed by fire, and immediate steps were taken to purchase a tug for the railway company. After careful survey of and report on the tug "Daring," of Seattle, this vessel was bought for the sum of $24,000. This tug and barge handle the Vancouver to Squamish and Vancouver to North Vancouver transfer business.

The question of light, water, and power needed at Squamish terminals and town has been gone into thoroughly; surveys, plans, and estimates made; and it is intended to commence the construction of a combined light, water, and power system there, giving power for the use of the railway-shops and light and water for the use and protection of the railway company's property and for the town.

On account of the insufficient housing accommodation for railway employees at Squamish, it was considered necessary, as a beginning, to erect twelve employees' cottages with modern conveniences. Tenders were called for. The contract was awarded to the lowest tenderer, and there are now eight of the twelve under construction.

A reconnaissance was made early in the year covering three possible routes connecting the Pacific Great Eastern near Clinton with the Canadian Northern Railway at Ashcroft, and an extremely favourable line, both as to grades and curvature, has been found, and at a cost not exceeding $42,000 per mile ready for operation.

Surveys for the replacing of several pumping-stations by gravity system at water-supply stations on the line have been made, estimates made, and the work is ready to be undertaken when the time is opportune.

PACIFIC GREAT EASTERN RAILWAY—CONSTRUCTION.

At the end of July it was decided to undertake further construction-work. Tenders were called for, and on August 24th a contract was entered into with the Northern Construction Company to carry out the works on a cost plus basis and working to certain definite unit prices. If the unit prices are exceeded, no percentage will be paid on the excess; but if the work is done at a less price than the quantities multiplied by the unit price, then the contracting firm will receive in addition to the 5½ per cent. on the actual cost of the work a bonus of 25 per cent. of the saving effected, the remaining 75 per cent. accruing to the railway company.

In connection with this method of doing work, the following extract from the *Engineering News-Record*, New York, of date January 2nd, 1919, comments as follows:—

"The cost-plus-sliding-scale-fee contract has operated successfully, and should not be permitted to disappear from public-works practice. It may well be that the details of this contract can profitably be altered, but its principle of assured fair compensation should be maintained inviolate. Government officials who have directed war construction, contractors who have performed this construction, and engineers who have watched the war-work are a unit in this opinion. They are supported by the record of a thousand million dollars' worth of work accomplished with remarkable speed and with astonishing harmony between engineers and contractors and workmen."

A start was not made till well on in September, but on December 31st there had been constructed the following:—

32 miles track-laying.
12 miles surfacing and ballasting.
43 miles telephone-line.
300,000 feet timber erected in bridges.
3 portable stations.
1 40,000-gallon water-tank and pumping-station.
3 tool houses.
800 cubic yards grading.
67,000 ties.

There is now being delivered from the Illinois Steel Company the balance of the rails and fastenings required to finish the track-laying on the Pacific Great Eastern Railway to Fort George. About 11,500 tons of rails and accessories have already been received, and in this connection I would draw your attention to the fact that the railway company is getting a much better rail than originally called for, owing entirely, however, to the peculiar position the rail-mills were in, due to the war; the United States Government having ordered plant changes, eliminating the production of Bessemer. The Pacific Great Eastern is receiving O.H. rails instead of Bessemer, and that O.H. is very much in favour with railroad companies the production in 1915 of 1,755,168 tons O.H. against 326,952 B. clearly shows.

Examinations, amongst others, of the following lines of railway and of their power and equipment have also been made during the year:—

British Columbia Electric lines.
Nakusp & Slocan.
Western Fuel Company.
Canadian Colliery lines.
Morrissey, Fernie & Michel.
Eastern British Columbia.
Corbin Coal & Coke Railway.
Dolly Varden Mines Railway.

A list of the Minister's certificates issued in accordance with the provisions of the Act and referring to all such matters connected with railways as provided for therein is given in Appendix A.

Accidents which have occurred on railways under the jurisdiction of this Department and reported as required by the Act are stated in Appendix B.

A list of the railways incorporated under Acts of the Legislature of British Columbia since 1883 is given in Appendix C.

A list of the companies operating logging and industrial railways, with their mileages, etc., is given in Appendix D.

Balance-sheets, in accordance with the provisions of the "Railway Act," have been filed by the following railway companies:—

Comox Logging Railway Company.
Crow's Nest Southern Railway Company.
British Columbia & Yukon Railway Company.
Victoria Terminal Railway & Ferry Company.
Victoria & Sidney Railway Company.
Menzies Bay Railway Company.
New Westminster Southern Railway.
Penticton Railway Company.
Pacific Great Eastern Railway.

I have the honour to be,
Sir,
Your obedient servant,
A. F. PROCTOR,
Chief Engineer.

APPENDICES.

APPENDIX A.

CERTIFICATES, 1918.

F. Bulloch— Cert. No.
Granting an extra $20 per month in connection with improvement, Songhees Reserve 428A
Canadian Northern Pacific Railway—
Approving 120-foot deck Howe truss 428
Approving 60-foot deck Howe truss 429
R. W. Macintyre—
Appointed as Temporary Assistant Engineer, Department of Railways 429A
British Columbia Telephone Company—
Permission to lay wires under British Columbia Electric Railway tracks at Newton Road, Scott Road, near Kennedy and Scott Road, Scott Station, Surrey, B.C. 430
Beaver River Lumber—
Permission to operate spur platform and conveyors in present arrangement 431
South-east Kootenay Railway—
Extension of time from February 27th, 1918, to February 27th, 1919 433
Naas & Skeena River Railway Company—
Extension of time from May 31st, 1918, to May 31st, 1919 ..... 413A
Menzies Bay Railway—
Extension of time from March 28th, 1918, to March 28th, 1919 435
Vancouver Power Company—
Permission to carry tracks under tracks of V.V. & E. Railway, Lots 2 and 3, Group 2, New Westminster 436
Graham Island Railway—
Extension of time to deposit $15,000 to August 20th, 1918 437
British Columbia Electric Railway—
Approval of Tariff No. 173 434
Graham Island Railway—
Extension of time to deposit $15,000 to November 20th, 1918 438
Northern Vancouver Island Railway—
Extension of time to March 21st, 1919 439
Saanich Municipality and British Columbia Electric Railway—
Permission to lay water-mains under British Columbia Electric tracks, Daisy Avenue, Daffodil Avenue, Blackwood and Chesterfield Roads 440

APPENDIX B.

ACCIDENT REPORT, 1918.

Persons injured.	Result.	Cause.
B.C. Electric Rly.		
Chauffeur	Killed	Auto struck by car.
Man	Died of injuries	"
Lady	"	"
"	Bruised and shock	"
"	Ribs broken and bruised	Struck by car.
Man, passenger	Rib broken	Fell in car.
Lady	"	"
Captain, fire-truck	Killed	Fire-truck struck car.
Driver, "	"	"
Lieutenant, "	"	"
Hoseman, "	"	"
" "	Bruised and shaken up	"
Man	Fractured skull	Auto collided with car.
" employee	Killed	Excessive current of electricity.
" "	"	Struck by auto while working on track.
" "	Fractured skull; fatal	Struck by car and fell, striking lamp-standard.
"	Wrists severely cut, shaken, and bruised	Auto smashed into car.
"	Slight concussion and badly bruised	Auto collided with street-car.
" employee	Broken ribs, bruised hip	Fell from roof of car.
" "	Wrist injured	Derailment of motor hand-car.
"	Killed	Truck collided with street-car.
"	Badly injured	Auto collided with car.
Chinaman	Killed	Auto struck by train.
Great Northern Rly.		
Man, employee	Shoulder bruised	Link-hanger fell on man.
" "	Strain of abdominal muscles	Lifting heavy timber.
" "	Head cut and shoulder sprained	Knocked off hand-car.
" "	Two ribs broken	Slipped and fell, pulling up old ties.
Italian	Killed	Gasolene-car struck by train.
Man employee	Severely sprained knee	Speeder hit by train, occupant thrown off.
" "	Sprained left arm	Fell off scaffold on bridge.
Crow's Nest Southern Rly.		
Man, employee	Loss of finger-nail and bruised hand	While unloading rails caught hand between.
Western Fuel Co.		
Man, employee	Killed	Caught between cars.
Chinaman, employee	Died from effects	Slipped and fell, car passing over left foot.
Comox Logging & Rly. Co.		
Man, employee	Killed	Derailment of locomotive.
" "	"	Breaking of link attached to broken loop of line attached to windfall.

APPENDIX C.

RAILWAYS INCORPORATED UNDER ACTS OF THE LEGISLATURE OF BRITISH COLUMBIA SINCE 1883.

Name of Railway.	Cap.	Year.	Remarks.
Adams River Rly	30	1903	Lapsed.
Alice Arm Rly	46	1898	"
Ashcroft & Cariboo Rly	40	1890	"
"	60	1890	"
"	52	1891	"
"	52	1896	"
Ashcroft, Barkerville & Ft. George Rly	49	1906	"
Arrowhead & Kootenay Rly	47	1898	"
"	65	1901	"
Atlin Short Line Rly. & Navigation Co.	79	1899	"
Atlin Southern Rly	80	1897	"
Barkerville, Ashcroft, & Kamloops Rly.	46	1897	"
Bedlington & Nelson Rly	47	1897	Declared for public benefit, c. 53, 1899.
Bedlington & West Kootenay Rly	46	1893	Lapsed
Bentinck Arm & Quesnel Rly	48	1907	"
Bella Coola & Fraser Lake	50	1906	"
British Columbia & Alaska Rly	56	1910	"
British Columbia & Northern	32	1903	"
Mackenzie Valley Rly	53	1906	"
British Columbia Central	51	1906	"
"	57	1910	"
British Columbia Northern & Alaska Rly.	52	1906	"
British Columbia Southern	36	1893	Amended, c. 47, 1893; repealed, c. 53, 1894; c. 39, 1894; c. 4, 1896; c. 53, 1896; c. 33, 1897. Declared for public benefit, c. 36, 1897.
British Columbia Electric Rly.—			
Vancouver Street Rly	31	1886	Lapsed.
"	38	1889	Incorporation.
Vancouver Electric Rly. & Light Co.	51	1890	Amendment.
National Electric Tramway & Light Co.	39	1889	Victoria Electric Rly. & Light Co., c. 62, 1894.
" "	52	1890	Amendment.
Westminster Street Rly	65	1890	
Westminster & Vancouver Tramway Co.	67	1890	Amended.
British Columbia Electric Co	49	1890	Act to amalgamate Westminster Street Rly. & Westminster & Vancouver Tramway Co.
"	71	1891	
"			
"	51	1894	Amended. Land grant.
Consolidated Rly. & Light Co	56	1894	Incorporation.
"	55	1896	Amendment.
Victoria Electric Rly. & Light Co.	63	1894	City of Victoria to supply light and power.
Victoria & British Columbia Electric Rly. Co. Agreement	81	1897	Supply electric light and power in and around City of Victoria.
British Columbia Yukon Rly	49	1897	Operating.
Burrard Inlet & Fraser Valley Rly	54	1891	Amended, c. 48, 1893, and c. 59, 1895. Lapsed.
Burrard Inlet Rly. & Ferry Co	53	1891	Lapsed.
Canadian Northeastern Rly	74	1911	Lapsed.
Canadian Northern Rly	48	1892	"
"	3	1910	*Main Lines.*—Agreement.
Canadian Northern Pacific Rly	4	1910	(*a.*) Yellowhead Pass to Vancouver, completed; (*b.*) Victoria to Barclay Sound, time extended to July 1st, 1917.
"	32	1912	Barclay Sound to Nootka Sound, time extended to July 1st, 1917.
"	57	1913	*Branch Lines.*—(*a.*) Westminster Bridge to Vancouver, time extended to July 1st, 1917; (*b.*) Westminster Bridge to Steveston, time extended to July 1st, 1917; (*c.*) Victoria to Patricia Bay, completed.
"	58	1913	Amendment to c. 4, 1910.
"	59	1913	*Terminals.*—Port Mann, New Westminster, Vancouver, Victoria, Steveston, and Patricia Bay.
"	61	1914	Further aid towards construction.
"	62	1914	Amendment to c. 57, 1913. Declared for public benefit, Order in Council, February 20th, 1917.
Canadian Pacific Rly	11	1880	Land grant.
Canadian Western Central Rly	20	1889	Land subsidy.
"	34	1889	Incorporation. Amended, c. 40, 1890; c. 36, 1892; c. 39, 1893; c. 4, 1895; c. 35, 1897. Lapsed.
Canadian Yukon Rly	50	1898	Lapsed.
Cariboo, Barkerville, & Willow River Rly.	62	1910	"
Cariboo Rly. (Ashcroft & Cariboo)	55	1897	Amendment, c. 50, 1897. Lapsed.
Cassiar Central Rly	35	1897	Crown grant.
"	52	1897	Incorporation. Lapsed.
Chilkat & Klehine Rly. & Navigation Co.	68	1901	Lapsed.
Chilliwack Rly	55	1891	Declared for public benefit, c. 43, 1893. Not built.
Columbia & Carbonate Mountain Rly	61	1890	Lapsed.
Columbia & Kootenay Rly	21	1889	Land subsidy.
"	62	1890	Amended, c. 49, 1892; c. 60, 1895. Declared for public benefit, c. 80, 1890.
Columbia & Kootenay Rly. & Transportation Co	25	1883	Amended, c. 24, 1884; c. 21, 1889; c. 41, 1890. Lapsed.
Columbia & Western Rly	8	1896	Subsidy Act. Repealed, c. 8, 1903.
"	54	1896	Incorporation. Amended, c. 12, 1898; c. 14, 1899; c. 4, 1900; c. 70, 1901; c. 9, 1903; c. 9, 1906. Declared for public benefit, c. 61, 1898.
Coast-Kootenay Rly	69	1901	Amended, c. 9, 1902. Declared for public benefit, c. 199, 1903.
Coast-Yukon Rly	58	1904	Lapsed.
Comox & Cape Scott Rly	71	1901	"
Comox Logging & Rly. Co.	63	1910	Operating.
Cowichan, Alberni, & Fort Rupert Rly	59	1904	Amended, c. 54, 1906. Lapsed.
Crawford Bay Rly	72	1901	Lapsed.

APPENDIX C—*Continued.*

RAILWAYS INCORPORATED UNDER ACTS OF THE LEGISLATURE OF BRITISH COLUMBIA—*Continued.*

Name of Railway.	Cap.	Year.	Remarks.
Crow's Nest & Kootenay Lake Rly	44	1888	Incorporation. Amended, c. 63, 1890; c. 56, 1891. Repealed, c. 53, 1894. Lapsed.
" "	72	1888	Land grant.
Crow's Nest & Northern Rly	58	1908	Amended, c. 64, 1911. Lapsed.
Crow's Nest Southern Rly	73	1901	Operating (G.N.R. or V.V. & E. Rly.).
Delta, New Westminster, & Eastern Rly	57	1894	Amended, c. 54, 1897. Lapsed.
Dolly Varden Mines Rly			Act, 1917. Time to complete, December 31st, 1918.
Delta Rly	34	1887	Lapsed.
Downie Creek Rly	52	1898	"
East Kootenay Logging Rly	52	1907	Operating.
East Kootenay Rly	61	1897	Lapsed.
East Kootenay Valley Rly	53	1898	"
Eastern British Columbia Rly	60	1908	Operating.
Esquimalt & Nanaimo Rly	13	1875	Land grant. Repealed, c. 16, 1882. Amended, c. 28, 1888; c. 45, 1888.
"	26	1903	Settlers' Rights Act.
"	33	1912	Agreement. Amended, c. 60, 1913. Declared for public benefit, c. 90, 1909.
Flathead Valley Rly	33	1903	Lapsed.
"	52	1909	"
Fording Valley Rly	63	1905	"
Fraser River Rly	26	1883	"
Graham Island Rly	54	1909	"
"	65	1910	Amendment. Time extended to 1919.
Grand Trunk Pacific Rly	19	1908	Crown grant. Amended, c. 22, 1909; c. 34, 1912. Operating.
Grouse Mountain Scenic Incline Rly	66	1911	Time extended to April 1st, 1919.
Hall Mines, Ltd., Tramway Act	59	1894	Lapsed.
Hardy Bay & Quatsino Sound Rly	55	1909	"
Harrison Hot Springs Tramway	68	1891	"
Howe Sound, Pemberton Valley, & Northern Rly	53	1907	$5,000 deposit with Minister of Finance.
Howe Sound & Northern Rly	67	1910	Amendment to c. 53, 1907. Amalgamated with Pacific Great Eastern.
Hudson Bay Pacific Rly	61	1908	Lapsed.
Imperial Pacific Rly	77	1901	"
Island Valley Rly	68	1910	"
Kamloops & Atlin Rly	83	1899	"
"	48	1900	"
"	78	1901	"
Kamloops & Yellowhead Pass Rly	58	1906	"
Kaslo & Lardo-Duncan Rly	58	1897	"
Kaslo & Slocan Rly	37	1892	Land grant.
"	52	1892	Incorporation. Amended, c. 41, 1894; c. 61, 1894; c. 36, 1897; C.P.R. was paid $100,000 for reconstructing Kaslo & Slocan Rly. (c. 37, 1912). Now operating.
Kaslo & Slocan Tramway Co	52	1893	Lapsed.
Kettle River Valley Rly	26	1910	Agreement.
"	35	1912	Ratify Agreement, Jan. 12th, 1912. Leased to C.P.R.
"	53	1912	By-law operating.
Kitimat Rly	54	1898	Amended, c. 84, 1899. Lapsed.
Kootenay & North-west Rly	55	1898	Amended, c. 85, 1899. Lapsed.
Kootenay Lake Shore & Lardo Rly	53	1893	Lapsed.
Kootenay & Athabasca Rly	25	1887	Land grant. Lapsed.
"	35	1887	Incorporation. Lapsed.
Kootenay, Cariboo, & Pacific Rly	34	1903	Lapsed.
Kootenay Central Rly	79	1901	"
"	35	1903	Declared for the public benefit.
Kootenay Rly. & Navigation Co.	29	1888	Land grant. Lapsed.
" "	46	1888	Change of title. Lapsed.
Columbia & Kootenay Rly. & Navigation Co.	35	1889	Lapsed.
Ladysmith Lumber Co. Rly	62	1908	Operating.
Lake Bennett Rly	80	1901	Lapsed.
Lardeau & Kootenay Rly	54	1893	"
Lardeau Rly	64	1897	"
Liverpool & Canoe Pass Rly	57	1891	"
Meadow Creek Rly	56	1909	Lapsed, $5,000 deposited with Minister of Finance.
Menzies Bay Rly	69	1910	Time extended to March 28th, 1919.
Mid-Provincial & Nechako Rly	81	1901	Amended, c. 45, 1902. Repealed, c. 45, 1902. Amended, c. 36, 1904; c. 60, 1906. Lapsed.
Midway-Penticton Rly	44	1899	
Morrissey, Fernie, & Michel Rly	37	1903	Lapsed.
Mountain Tramway & Electric Rly	56	1898	"
Mount Tolmie Park & Cordova Bay Rly	55	1893	"
Naas & Skeena Rivers Rly	69	1911	Amended, c. 79, 1916. Extension of time to May 31st, 1919.
Nakusp & Slocan Rly	56	1893	Amended, c. 43, 1894. Operated by C.P.R.
Nanaimo-Alberni Rly	66	1897	Lapsed.
Nanaimo Electric Tramway Co	69	1891	"
Nanaimo Railway Act	25	1881	"
Nelson & Fort Sheppard Rly	58	1891	Amended, c. 42, 1894; c. 37, 1897.
"	38	1892	Land grant. Declared for the public benefit, c. 57, 1893.
"	42	1894	Amended, c. 42, 1894; c. 37, 1897.
New Westminster-Port Moody Rly	14	1882	Amended, c. 25, 1884. Lapsed.
Nelson & Arrow Lake	57	1893	Lapsed.
New Westminster & Vancouver Short Line Rly	37	1889	Amended, c. 67, 1892; c. 60, 1896. Lapsed.
New Westminster Southern Rly	27	1883	Lapsed.
" "	36	1887	Amended, c. 36, 1889. Operating. G.N.P. purchased from Port Kells to Bridge, New Westminster. Since sold to Canadian Northern.
Nicola, Kamloops, & Similkameen Coal & Rly. Co.	47	1891	Amended, c. 38, 1903. Declared for public benefit, c. 164, 1903.

APPENDIX C—*Concluded.*

RAILWAYS INCORPORATED UNDER ACTS OF THE LEGISLATURE OF BRITISH COLUMBIA—*Concluded.*

Name of Railway.	Cap.	Year.	Remarks.
Nicola Valley Rly.	59	1891	Declared for the public benefit.
"	37	1893	Chap. 50, 1892.
North Star & Arrow Lake Rly.	58	1898	Amended, c. 86, 1899. Lapsed.
Northern Vancouver Island Railway	71	1910	
" "	70	1911	Time extended to March 28th, 1919. $5,000 deposited with Minister of Finance.
Okanagan & Kootenay Rly.	40	1890	Lapsed.
"	64	1890	"
Osoyoos & Okanagan Rly.	59	1893	"
Pacific Great Eastern Rly.	34	1913	Amended, c. 61, 1913; c. 62, 1913; c. 65, 1914.
"	36	1912	Under construction.
Pacific Northern and Eastern Rly.	39	1903	Lapsed.
Pacific Northern and Omineca Rly.	50	1900	Amended, c. 55, 1902; c. 77, 1902; c. 40, 1903; c. 67, 1905; c. 58, 1909. Lapsed. Security deposited with Minister of Finance.
Pacific Rly.	73	1910	Lapsed.
Peace & Naas River Rly.	73	1911	"
Penticton Rly.	74	1910	"
Portland & Stickine Rly.	59	1898	"
Portland Canal Short Line	59	1909	Amended, c. 74, 1911. Now called Canadian North-eastern Rly. Abandoned.
Portland Canal Rly.	56	1907	Lapsed.
Port Moody, Indian River, & Northern Rly.	75	1910	"
Prince Rupert & Port Simpson Rly.	60	1909	"
Quatsino Rly.	42	1903	"
Queen Charlotte Island Rly.	83	1901	Amended, c. 57, 1907.
"	63	1905	Lapsed.
Queen Charlotte Rly.	76	1910	"
Rainy Hollow Rly.	58	1907	"
Red Mountain Rly.	61	1893	Declared for public benefit, c. 60, 1895.
Revelstoke & Cassiar Rly.	61	1898	Lapsed.
Rock Bay & Salmon River Rly.	51	1900	"
St. Mary's & Cherry Creek Rly	64	1906	
St. Mary's Valley Rly.	65	1906	
Shuswap & Okanagan Rly.	26	1887	Amended, c. 30, 1888; c. 42, 1890; c. 37, 1891.
Skeena River & Eastern Rly.	62	1898	Lapsed.
Skeena River Rly. Colonization & Exploration Co.	63	1898	"
South-east Kootenay Rly.	64	1898	"
"	63	1906	Amended, c. 61, 1909. Time extended to February 27th, 1919.
South Kootenay Rly.	88	1898	Lapsed.
South Okanagan Rly.	66	1906	"
Stave Valley Rly.	70	1905	"
Stickeen & Teslin Rly. Navigation & Colonization Co.	71	1897	"
Toad Mountain & Nelson Tramway Incorporation	70	1891	Amended, c. 44, 1898; c. 40, 1900.
Toad Mountain & Nelson Tramway Incorporation	185	1897	Chap. 58, 1901, an Act respecting the Incorporation of Tramway, Telephone, and Telegraph Companies.
Tramway Inspection	50	1910	Amended, c. 51, 1911.
Upper Columbia Navigation & Tramway Co.	50	1891	
Vancouver & Grand Forks Rly.	84	1901	Lapsed.
Vancouver & Lulu Island Electric Rly. & Improvement Co	61	1891	"
Vancouver & Lulu Island Rly.	60	1891	Amended, c. 73, 1897; c. 52, 1900. Declared for public benefit, c. 86, 1901.
Vancouver & Nicola Valley Rly.	63	1908	Amended, c. 80, 1910. Lapsed.
Vancouver & Northern Rly.	64	1909	Lapsed.
Vancouver & Westminster Rly.	53	1900	Amended, c. 78, 1902.
Vancouver Island Hydro-electric & Tramway Co., Ltd.	.....	.....	Incorporated, joint-stock company, November 12th, 1912, Lapsed.
Vancouver Land & Rly. Co.	15	1882	Lapsed.
Vancouver-Nanaimo Rly. Transfer Co.	74	1897	"
Vancouver, Northern, & Yukon Rly.	89	1899	Amended, c. 55, 1900. Lapsed.
Vancouver, Northern, Peace River, & Alaska Rly. & Navigation Co.	62	1891	Lapsed.
Vancouver, Victoria, & Eastern Rly. & Navigation Co.	75	1897	Declared for public benefit, c. 172, 1905.
Vernon & Okanagan Rly.	63	1891	Lapsed.
Victoria & Barkley Sound Rly.	65	1909	"
Victoria & Northern America Rly	64	1891	"
Victoria & Saanich Rly	16	1886	"
"	29	1886	"
Victoria & Seymour Narrows Rly.	79	1902	"
Victoria & Sidney Rly.	39	1892	Subsidy. } Operated by G.N.R.
"	66	1892	Incorporation. }
Victoria & Yellowhead Pass Rly. Aid	70	1902	Lapsed.
Victoria Terminal Rly. & Ferry Co.	85	1901	Amended, c. 54, 1905 } Operated by G.N.R.
" "	86	1901	By-law. }
Victoria, Vancouver, & Westminster	64	1894	Amended, c. 76, 1897. Lapsed.
Victoria Harbour Rly. Co.	44	1911	Lapsed.
Wellington Colliery Rly.	28	1883	"
"	44	1911	Operating.
Yale Northern Rly.	87	1901	Lapsed.
Yukon Mining & Trading & Transportation Co.	38	1897	
Yukon Mining & Trading & Transportation Co.	77	1897	"

APPENDIX D.

LIST OF COMPANIES OPERATING LOGGING AND INDUSTRIAL RAILWAYS.

Name of Railway.	No. Miles.	Locos.	Other Equipment.
Abbotsford Timber & Trading Co	8.0	1	17 Hercules steel logging-trucks, 1 flat car.
Alberni Pacific Logging Rly	5.0	1	10 logging-cars, 7 logging-trucks, 1 workmen's passenger-car.
Anderson, F. B., Logging Co	4.0	1	1 flat car, 10 logging-cars, 8 logging-trucks.
Bloedell, Stewart & Welsh Logging Rly	9.7	2	3 flat cars, 18 logging-cars, 4 logging-trucks.
Britannia Mining & Smelting Co., Ltd	35	25*	15 flat cars, 250 ore-cars.
B.C. Mills Timber & Trading Co	26.5	6	1 box car, 2 flat cars, 62 logging-trucks, 1 ballast-car, 2 pile-drivers, 2 snow-ploughs.
Canadian Collieries (Dunsmuir), Ltd	10.0	20	8 box cars, 25 flat cars, 383 coal-cars, 25 work-cars, 2 passenger-cars, 8 workmen's passenger-cars, 1 steam-shovel, 2 pile-drivers, 1 snow-plough.
Capilano Timber Co.	5.48	2	1 flat car, 12 logging-cars, 27 logging-trucks, 1 steam-shovel, 1 pile-driver.
Campbell River Lumber Co	5.0	2	4 logging-trucks.
Canadian Panama Lumber & Logging Co	7.0	1	14 logging-trucks, 2 work-cars.
Canadian Robert Dollar Co., Ltd	5.0	1	6 logging-cars, 16 sets logging-trucks.
Canadian Western Fuel Co	19.2	5	42 flat cars, 564 coal-cars, 21 work-cars, 2 workmen's passenger-cars, 1 crane.
Clayburn Coal Co., Ltd	3.5	2*	11 dump-cars, 4 hoppers, 3 flat cars.
Columbia River Lumber Co	27.0	3	2 box cars, 2 flat cars, 82 logging-cars, 3 log-loaders.
Corbin Coal & Coke Co	10.0	2	96 coal-cars, 8 work-cars, 2 steam-shovels, 1 snow-plough.
Crow's Nest Pass Lumber Co	9.0	2	3 flat cars, 3 dining-cars, 1 office car, 3 bunk-cars.
Comox Logging Co	45.0	6	15 logging-trucks, 200 flat cars, 2 speeders.
Clayton Lumber Co	1.0	....	4 small iron logging-trucks.
Dolly Varden Mines Co	17.0	3	1 box car, 15 flat cars, 2 conductors' vans.
Eagle Timber Co	2.0	1	1 box car, 1 flat car, 7 logging-trucks, 1 pile-driver, 1 log-loader.
East Kootenay Logging Rly	10.0	1	24 logging-cars, 2 log-loaders.
Eastern British Columbia Rly. (Corbin Coal & Coke).	14.0	3	8 box cars, 9 flat cars, 1 baggage-car, 1 passenger car, 1 pile-driver, 1 snow-plough.
Eagle River & Northern Rly	15.86	2	1 box car, 12 flat cars, 20 logging-cars, 1 work-car, 3 ballast-cars, 1 pile-driver.
Galbraith Logging Rly	3.5	1	4 logging-trucks, 1 donkey and goader.
Gordon Development Co	3.0	1	1 flat car, 10 logging-trucks.
Granby Consolidated Mining, Smelting & Power Co., Ltd.	5.25	11	2 flat cars, 12 stock-cars, 50 coal-cars, 3 logging-cars, 20 baggage-cars, 1 hoist.
Hedley Gold Mining Co	1.5	2	40 ore-cars.
Heaps, E. H., & Co., Ltd	11.25	1	4 flat cars, 15 logging-trucks, 3 oil-tanks, 2 water-tanks.
International Timber Co	25.0	3	2 flat cars, 60 logging-trucks, 10 work-cars, 1 baggage-car, 1 workmen's passenger car, 1 pile-driver.
Keystone Logging Co	7.0	2	1 flat car, 1 pile-driver, 1 log-loader.
Khaka International Trading Co	1.25	1	1 logging-truck.
King, M. B., Lumber Co. Ltd	2.0	1	2 flat cars, 1 logging-car.
Lamb Lumber Co	4.0	1	1 flat car, 10 logging-cars, 4 logging-trucks.
Mainland Cedar Co., Ltd	2.6	1	1 box car, 10 logging-cars, 4 logging-trucks, 1 work-car, 1 pile-driver, 2 log-loaders.
Mayo Lumber Co	0.5	1	2 logging-cars.
Merrill-Ring-Moore Logging Co., Ltd	2.5	2	19 logging-cars.
Morrissey, Fernie & Michel Rly	10.85	5	6 box cars, 49 coal-cars, 1 passenger car, 5 workmen's passenger cars, 1 conductor's car, 1 snow-plough, 1 crane.
Nimpkish Timber Co., Ltd.	7.0	2	21 pr. logging-cars, 12 pr. logging-trucks, 1 pile-driver.
Pacific Coast Coal Mines Rly	9.35	3	3 flat cars, 48 coal-cars.
Pacific Mills, Ltd	3.0	2	25 logging-cars, 4 logging-trucks, 2 pile-drivers, 2 log-loaders.
Port Moody Coquitlam Rly	14.5	1	6 flat cars, 12 logging-cars.
Ross Saskatoon Lumber Co	12.0	2	27 logging-cars.
Smith Hutchison Logging Rly	2.0	1	2 sets logging-trucks.
Southgate Logging Co	6.25	2	4 yarding-engines, 1 flat car, 11 logging-cars, 2 logging-trucks, 1 pile-driver.
Straits Lumber Co	9.0	1	18 logging-trucks, 1 pile-driver.
Timberland Lumber Co	3.0	1	1 ore-car, 4 logging-cars, 1 workmen's passenger-car.
Victoria Lumber Co	20.0	3	36 sets logging-trucks, 3 flat cars.
Wilson Bardy, Ltd	5.0	2	1 flat car, 16 logging-trucks.
Totals	465.54	145	

* Electric.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

ANNUAL REPORT

OF

THE PROVINCIAL GAME WARDEN

OF THE

PROVINCE OF BRITISH COLUMBIA

1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The undersigned has the honour to present the Report of Provincial Game Warden for the year ending December 31st, 1918.

J. W. DE B. FARRIS,

Attorney-General.

Attorney-General's Department,

Victoria, B.C., February 25th, 1919.

PROVINCIAL GAME WARDEN'S OFFICE,

VICTORIA, B.C., January 31st, 1919.

Honourable J. W. de B. Farris, K.C., M.P.P.,

Attorney-General, Victoria, B.C.

SIR,—I have the honour to submit herewith my Report for the year ending December 31st, 1918.

I have the honour to be,

Sir,

Your obedient servant,

WM. G. McMYNN,

Provincial Game Warden.

REPORT FOR THE YEAR 1918.

The year under review marks the third important step in the history of game-protection in this Province. The Game Department came into existence in 1905, and commencing with a small appropriation and a limited staff carried on a sporadic but successful effort at game-protection with the means at its disposal. In 1913 the resident firearms licence was introduced, which received a ready support from the shooting public. The number of Game Wardens was largely increased, and the revenue exceeded expectations by increasing from (approximately) $6,000 in 1912 to $107,000 in 1913. At the last session of the Legislature, in April, 1918, the "Game Act" was amended to allow of the creation of a Game Conservation Board, which met with widespread approval, it being readily recognized that a course which had been adopted with such proved beneficial results in other countries, notably in the United States, clearly demonstrated the practicability of applying to the conservation and propagation of game a wider outlook and more varied opinion than could be obtained by individual effort. Provision was also made for the administration of the Game Department being amalgamated with the duties of the Provincial Police, and the Superintendent of Provincial Police was created ex officio the Provincial Game Warden.

So radical a change in the affairs of a Department in which the general public so largely share was bound to meet with a certain amount of adverse criticism, and considerable skepticism was expressed as to the success which would attend the enforcement of the game laws by police officers. The changes, however, were favourably received by the sporting community as a whole, and resolutions endorsing the legislation foreshadowed were passed by some of the more important game associations. The creation of a Game Conservation Board was felt to be a forward step at a time when conservation was of paramount importance, and the opportunities afforded for the energies of a Game Board representative of the whole Province have amply demonstrated the successful nature of the change. Co-operation and a clearer understanding with the Dominion authorities was also necessary for the better working-out of the "Migratory Birds Convention Act," and the recommendations of the Game Conservation Board resulted in the establishment of zones for the open seasons for wild-fowl shooting, which practically met the requirements of the treaty. Migratory non-game birds and insectivorous birds also came in for a greater measure of protection.

Whilst much had been achieved in the protection of game and the enforcement of the law in past years, the time had arrived for a more thorough and organized effort. The Deputy Inspectors of the Provincial Police, and all officers under them, threw themselves wholeheartedly into their new duties, and a fresh impetus was given to the enforcement of the law, as evidenced by the increase of revenue and convictions. The success, however, of the enforcement of the law should not be measured entirely by the number of convictions recorded, but rather by the prevention of violations and the attitude of the shooting public. It is becoming more increasingly recognized that education is the most important factor in all matters pertaining to successful conservation. The system of licensing creates two motives in the mind of the purchaser—either the licence is bought from a sense of upholding the Department and protecting the game, or else it is bought merely as a means of avoiding prosecution. The latter motive can only be eradicated by fostering and increasing an interest in conservation, and every educational opportunity should be utilized to impress, not only on sportsmen, but on boys also, the necessity of protection, the importance of immunity from molestation to game during the breeding season, and the destruction of vermin preying upon game birds, in which the shooting public can so largely assist. The farmers, too, should be encouraged to look more leniently on the "damage to crops" (so commonly exaggerated) by insectivorous or game birds, for there is proof beyond question that bird-life is one of the most indispensable balancing forces of nature.

On the recommendation of the Game Conservation Board, regulations governing the payment of bounty were revised, and an increase in the bounty payable on cougar was suggested. Provincial constables were also furnished, in many cases, with suitable weapons and ammunition, and instructed, wherever possible, whilst in the fulfilment of their duty, to assist in the destruction of predatory animals and birds.

The amendments to the "Game Act," which are dealt with more particularly under a separate heading in this report, have opened a new era for game-protection in British Columbia. The report of the Chairman of the Game Conservation Board, dealing more particularly with the Lower Mainland and Gulf Islands and the work of this Department during the past year, contains the following:—

"Upon assuming my duties as a member of the British Columbia Game Conservation Board last May, I endeavoured to familiarize myself with the existing conditions of the game of the Lower Mainland and Gulf Islands.

"I found, upon investigation, that the Fraser Valley, the natural habitation of almost all kind of bird-life, was well stocked with almost all the various game birds that will thrive in this district, but that there was a marked laxity of public interest in the conservation of these birds, due, I believe, to the way the game regulations of the Province had been enforced, and also due to the fact that, although sporting men of the various districts had been contributing year after year to protection and conservation by their annual firearms licences, yet they had received very little, if any, of either.

"The change in the manner of protection brought into effect by the amendments to the 'Game Act' just previous was looked upon with disfavour in a great many localities, so that the prospects for arousing public interest and support were very slight.

"The sentiment regarding the game on the Gulf Islands and inlets adjacent was very much the same as found in the Fraser Valley. Violations of the game laws were common.

"I am pleased to report to you that this condition has entirely changed; there has been a very marked awakening of public interest in the protection and conservation of our bird and animal life throughout these sections, and the progress of the movement is indeed encouraging. The game associations have awakened and have taken on new life. To-day they are behind the authorities for conservation and propagation.

"The sporting men are keen in their endeavours to help the game officers in the fulfilment of their duties. This awakening bids fair to place British Columbia in its true light. Show to the world the value of the great resource we have in both big game and game birds, and make this Province what it should be—the paradise for true sportsmen.

"The reverse of opinion has been gradually brought about by reason of the attitude taken by your Department, convincing all that you intended to and would enforce the game regulations and laws of the Province.

"The officers have been untiring in their efforts to see that all orders were carried out, and to bring wanton destroyers of game to their just deserts. Another great factor has been in showing the sportsmen that something is being done for the propagation of game by the authorities, and that this will be carried on."

Energetic efforts have been made to increase the stock of pheasants, and the principal farm for raising the same has been started at the Wilkinson Road Lock-up, Victoria District, where it is hoped some 4,000 birds will be raised next spring.

The lease on the land at the Horst Farm, in the vicinity of Chilliwack, which had been formerly used for this purpose, expired at the end of the year; this location, having served its purpose, has now been abandoned, and there is no doubt that much better results will be obtained on Vancouver Island. Beyond the Horst Farm there was no provision for game sanctuaries for birds, and the Board early recommended and arranged for the creation of a game sanctuary in the vicinity of Victoria, comprising Elk and Beaver Lakes and the watershed surrounding these waters.

The retiring Provincial Game Warden and Deputy Game Wardens, whose services were automatically dispensed with at the end of last March by the passing of the amending Bill, were granted a gratuity in accordance with the length of their service, whilst those whose services were retained were merged with the staff of the Provincial Police.

AMENDMENTS TO THE "GAME ACT."

By the 1918 amendments to the "Game Act," which came into effect on April 23rd, 1918, the administration of this Department was placed in the hands of the Superintendent of Provincial Police, who became ex officio the Provincial Game Warden, and all Provincial Police officers became ex-officio Game Wardens. Provision was also made for the appointment of a Chief Game Inspector, under the direction of the Provincial Game Warden. A Game Conservation

Board was created, consisting of five members, of which the Curator of the Provincial Museum became ex officio the Secretary and the Chief Game Inspector an ex-officio member. The remaining three members were appointed by the Lieutenant-Governor in Council, and the Board as constituted stands as follows: Dr. A. R. Baker, of Vancouver, Chairman; F. Kermode, Curator of Provincial Museum, Victoria, Secretary; F. H. Mobley, M.L.A., of Atlin; F. A. Dunn, of Cranbrook; R. Gidley, Acting Chief Game Inspector, Victoria.

The Board is required to meet four times in each year, at the times and places designated by the Minister, to receive and consider suggestions for the conservation, propagation, and importation of game, and to advise the Lieutenant-Governor in Council upon all matters arising under the Act.

Other amendments to the undermentioned sections of the "Game Act" provided for:—

Section 9. Inclusion on the protected list of game animals and birds of pigeons and doves and Western and American robins and thrushes.

Section 10. A reduction in the bag limit, which is now as follows, subject always to seasons being declared open in that behalf by the Lieutenant-Governor in Council: 1 moose; 1 wapiti; 2 caribou; 2 mountain-sheep of any one species, or not more than three in all; 2 mountain-goat; 3 deer of any one species, or not more than four in all; 250 ducks.

Section 24, subsection (*a*). Altering the farmer's free licence, entitling him to shoot only on his own land.

Section 24, subsection (*e*). Alteration in the non-resident big-game licences, the fee being amended to $25, subject to a schedule of fees for game killed, namely: For grizzly bear, moose, sheep, wapiti, or caribou, $25 each; for black or brown bear, mountain-goat, or mule-deer, $15 each; for deer of any other species, $5 each.

Section 24, subsection (*h*). Amending the non-resident angler's licence, and making the same valid from March 25th to November 15th in each year, in conformance with the Dominion Fishing Regulations, and amending the fee for this licence to $1 per day up to five days, or $5 for the season.

Section 45, subsection (2). Making pit-lamping a prison offence, without the option of a fine.

REVENUE AND EXPENDITURE.

The revenue obtained this year from the sale of firearms licences shows a surplus of $15,500 over the amount estimated by the Honourable the Minister of Finance as likely to be received, and this figure is (approximately) $10,000 in excess of the receipts obtained in 1917-18. There is also an additional sum of $1,300 which has been collected but only reported to me subsequent to the date of tabulating this report, which, together with a few miscellaneous receipts and further collections from the sale of trappers' licences, will bring the total for the year to over $77,000.

By comparison with last year the figures are as follows:—

	1917.	
Resident licences—		
O.F.L., 14,020	$35,050 00	
G.F.L., 2,864	14,320 00	
S.F.L., 1,141	11,410 00	
Guides, 30	150 00	
F.F.L., 4,940	.....	
P.F.L., 2,273	.....	
		$60,930 00
Non-resident licences—		
Big game, 31	$ 3,100 00	
Bear, 10	250 00	
Anglers, 134	670 00	
Weekly bird, 3	15 00	
Season bird, 2	100 00	
		$ 4,135 00
Miscellaneous receipts		422 50
		$65,487 50

		1918 (to Dec. 31st).
Resident licences—		
O.F.L., 16,432	$41,080 00	
G.F.L., 2,970	14,850 00	
S.F.L., 1,524	15,240 00	
Guides, 27	135 00	
F.F.L., 3,200	.....	
P.F.L., 1,789	.....	
		$71,305 00
Non-resident licences—		
Big game, 51	$ 1,275 00	
Big game, fees	2,205 00	
Bear, 5	125 00	
Anglers' season, 85	425 00	
Anglers' daily, 42	42 00	
Weekly bird, 2	10 00	
Season bird, 3	150 00	
		$ 4,232 00
		$75,537 00

It will be noticed from the above comparison that the increase is chiefly derived from the ordinary $2.50 and trappers' licences.

Great economy, as compared with previous years, has been practised in the expenditure for game-protection, and the work of the police has only been charged for where expenses were incurred for purely game matters. During the open season special constables were engaged, particularly for the enforcement of the Act, and their salaries and expenses were consequently all charged to this Department. A synopsis of the expenditure to date is as follows:—

Appropriation as per Vote No. 45		$35,000 00
Expenditure from April 1st, 1918, to December 31st, 1918—		
Salaries	$9,172 44	
Expenses of Game Board	637 83	
Overhead charges	1,831 01	
Expense accounts	3,638 79	
Pheasant-raising	2,156 38	
Releasing red deer	151 54	
Sundries	70 00	
Payments account, 1917	590 88	
		18,218 87
		$16,781 13
Less bounties paid		3,152 50
Balance on hand		$13,628 63

By comparison with the year 1918-19, an immense saving has been effected in the cost of game-protection, the result being as follows:—

	Revenue.	Expenditure.
1917-18	$65,487 50	$55,033 80
1918 (Dec. 31st)	75,537 00	18,218 87
		$36,814 93

Revenue derived from Sale of Non-resident Licences from April 1st, 1918, to December 31st, 1918.

Government Agency.	Big Game.			Spring Bear.		Season Bird.		Weekly Bird.		Season Angler.		Daily Angler.		Totals.
	No.	Amount.	Fees.	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	
Telegraph Creek	11	$ 275 00	$1,965 00	..	....	..	.....	..	....	..	....	..	....	$2,240 00
Golden	17	425 00	115 00	..	....	..	.....	..	....	1	$ 5 00	..	....	545 00
Fernie	6	150 00	30 00	..	....	..	.....	..	....	11	55 00	3	$ 3 00	238 00
Cranbrook	7	175 00	.....	..	....	..	.....	..	....	10	50 00	1	1 00	226 00
Vancouver	5	125 00	.....	2	$ 50 00	..	.....	1	$ 5 00	4	20 00	10	10 00	210 00
New Westminster	..	.....	.....	..	....	2	$100 00	..	....	11	55 00	18	18 00	173 00
Barkerville	2	50 00	95 00	..	....	..	.....	..	.....	..	....	..	....	145 00
Victoria	2	50 00	.....	..	....	1	50 00	..	....	31	155 00	..	....	255 00
Fort George	1	25 00	.....	3	75 00	..	.....	..	....	2	10 00	..	....	110 00
Greenwood	..	.....	.....	..	....	..	.....	..	....	4	20 00	..	....	20 00
Nanaimo	..	.....	.....	..	....	..	.....	..	....	3	15 00	5	5 00	20 00
Alberni	..	.....	.....	..	....	..	.....	..	....	3	15 00	4	4 00	19 00
Kamloops	..	.....	.....	..	....	..	.....	1	5 00	1	5 00	1	1 00	11 00
Duncan	..	.....	.....	..	....	..	.....	..	....	1	5 00	..	....	5 00
Nelson	..	.....	.....	..	....	..	.....	..	....	1	5 00	..	....	5 00
Princeton	..	.....	.....	..	....	..	.....	..	....	1	5 00	..	....	5 00
Grand Forks	..	.....	.....	..	....	..	.....	..	....	1	5 00	..	...	5 00
Totals	51	$1,275 00	$2,205 00	5	$125 00	3	$150 00	2	$10 00	85	$425 00	42	$42 00	$4,232 00

Revenue derived from Sale of Resident Gun Licences.

Government Agency.	O.F.L.		G.F.L.		S.F.L.		Guides.		F.F.L.	P.F.L.	Totals.
	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	No.	No.	
Vancouver	4,140	$10,350 00	623	$ 3,115 00	106	$ 1,060 00	..	.....	256	272	$14,525 00
New Westminster	2,242	5,605 00	94	470 00	36	360 00	..	.....	579	27	6,435 00
Victoria	1,931	4,827 50	127	635 00	35	350 00	13	$ 65 00	28	5	5,877 50
Fort George	65	162 50	217	1,085 00	257	2,570 00	..	.....	98	47	3,817 50
Vernon	1,100	2,750 00	98	490 00	56	560 00	..	.....	268	22	3,800 00
Nanaimo	1,268	3,170 00	81	405 00	10	100 00	..	.....	75	...	3,675 00
Prince Rupert	486	1,215 00	260	1,300 00	98	980 00	..	.....	21	160	3,495 00
Fernie	455	1,137 50	346	1,730 00	54	540 00	..	.....	22	6	3,407 50
Kamloops	559	1,397 50	97	485 00	91	910 00	..	.....	615	75	2,792 50
Nelson	427	1,067 50	107	535 00	40	400 00	..	.....	158	165	2,002 50
Cumberland	585	1,462 50	80	400 60	13	130 00	..	.....	112	...	1,992 50
Duncan	539	1,347 50	20	100 00	9	90 00	..	.....	162	...	1,537 50
Golden	77	192 50	123	615 00	50	500 00	..	.....	58	8	1,307 50
Cranbrook	226	565 00	59	295 00	30	300 00	..	.....	32	42	1,160 00
Revelstoke	106	265 00	79	395 00	48	480 00	..	.....	66	85	1,140 00
Fairview	290	725 00	44	220 00	10	100 00	..	.....	49	16	1,045 00
Kaslo	110	275 00	63	315 00	44	440 00	..	.....	40	224	1,030 00
150-Mile House	66	165 00	20	100 00	76	760 00	..	.....	48	9	1,025 00
Alberni	256	637 50	40	200 00	18	180 00	..	.....	33	8	1,017 50
Rossland	253	632 50	66	330 00	5	50 00	..	.....	31	34	1,012 50
Greenwood	235	587 50	41	205 00	17	170 00	..	.....	66	68	962 50
Fort St. John	3	7 50	11	55 00	84	840 00	..	.....	28	...	902 50
Grand Forks	169	422 50	65	325 00	11	110 00	..	.....	36	50	857 50
Princeton	193	482 50	34	170 00	18	180 00	..	.....	17	73	832 50
Merritt	153	382 50	31	155 00	29	290 00	..	.....	58	16	827 50
Fort Fraser	48	120 00	11	55 00	61	610 00	..	.....	35	3	785 00
Clinton	81	202 50	8	40 00	44	440 00	..	.....	87	21	682 50
Quesnel	15	37 50	25	125 00	43	430 00	..	.....	36	45	592 50
Smithers	46	115 00	11	55 00	42	420 00	..	.....	44	77	590 00
Ashcroft	137	342 50	22	110 00	11	110 00	..	.....	7	50	562 50
Wilmer	74	185 00	17	85 00	18	180 00	..	.....	13	9	450 00
Lillooet	55	137 50	21	105 00	12	120 00	1	5 00	17	64	367 50
Telegraph Creek	1	2 50	1	5 00	19	190 00	13	65 00	...	...	262 50
Anyox	20	50 00	22	110 00	7	70 00	..	.....	...	35	230 00
Atlin	2	5 00	1	5 00	21	210 00	..	.....	1	41	220 00
Yale	20	50 00	5	25 00	1	10 00	..	.....	4	31	85 00
Totals	16,432	$41,080 00	2,970	$14,850 00	1,524	$15,240 00	27	$135 00	3,200	1,789	$71,305 00

ENFORCEMENT OF THE LAW.

A noticeable increase in the number and variety of convictions for violations of the game laws is the outstanding result of the nine months' work of the Provincial Police, and there has been more widespread control of all kinds of shooting throughout the Province than could possibly have been achieved by the Game Wardens previously employed.

A comparison of statistics for the years 1917 and 1918 demonstrates at a glance these results.

Recapitulation.

	Informations laid.	Convictions.	Suspended Sentences.	Cases withdrawn.	Cases dismissed.	Guns confiscated.	Fines imposed.
1918.							
January 1st to March 31st	27	22	3	2	..	..	$ 440 00
April 1st to December 31st	167	137	5	7	13	5	2,901 00
	194	159	8	9	13	5	$3,341 00
1917.							
January 1st to December 31st	111	97	..	4	10	..	$1,763 50

In the more settled districts where good roads are to be found and in the vicinity of the large towns the ever-increasing use of the automobile is revolutionizing the methods of obtaining shooting. Districts formerly inaccessible to hunters with limited time to indulge in this sport can now be readily reached for week-end shooting by aid of the car. Unfortunately, whilst improving the opportunities for sport, this method cannot but react unfavourably upon the game birds, as opportunities for illegal shooting both in and out of season are greatly facilitated.

The use of automobiles as a means of pit-lamping is also frequent, but with the long-advocated amendment in operation, making this practice a prison offence, a determined effort has been made to put a stop to it. Three convictions, resulting in gaol sentences of thirty days each, have been obtained on Vancouver Island, and it is to be hoped these examples will act as a deterrent to others.

A stricter enforcement of the law has been put into execution in the northern part of the Province. Telegraph Creek, where for years past the Indians have done much as they pleased, was visited early in the year by the Acting Chief Game Inspector, and two convictions were obtained against persons having moose-meat in their possession out of season. An officer was subsequently stationed at this place, and a more strict watch is being kept on the exportation of big-game trophies. Other successful and important prosecutions to be noticed are three cases of persons "allowing dogs to run deer," this being one of the most difficult offences to prove; and one case of "removing traps legally set," which resulted in the conviction of an Indian (son of a chief), and for which a fine and gaol sentence was imposed. Two convictions for trapping out of season, in which heavy penalties were imposed, were obtained in the Columbia and Fort George Districts, both entailing considerable arduous work on the part of the officers making the arrests.

Just prior to and during the greater part of the open season for game birds a number of special constables were temporarily employed to assist the regular police in their work, and the most favoured shooting districts were thoroughly combed for hunters who had risked not taking out their licences.

The work of the force may be more particularly summed up in the following extracts from the Chairman of the Game Conservation Board, the Deputy Inspectors, and Chief Constables:—

Chairman of the Game Conservation Board.

"I am pleased to report to you that all the officers in this district (Lower Mainland and Islands adjacent) under your supervision have been untiring in their efforts to enforce the game laws, and have shown extreme courtesy in assisting me to gather any information I required, and have assisted always in our endeavours for the protection and conservation of game."

Acting Chief Game Inspector.

"In the districts visited by me, which included Telegraph Creek, Kamloops, Clinton, and the Lower Mainland, also Vancouver Island, I find that game conditions under the new regime are exceptionally good. I must say that the enforcement of the 'Game Act' during the year 1918 has given the greatest satisfaction to the sporting public.

"On Vancouver Island complaints of hunting deer with head-lights seems to be the chief complaint, regardless of the fact that a prison term must be imposed without the option of a fine. In my dealings with the Provincial Police I have found them always ready to give every possible assistance when requested.

"During the past hunting season a greater number of special constables than usual have been put on, with the result that the prosecutions have been more numerous than usual."

The Deputy Inspector, Vancouver.

"A considerable portion of this district lies on the Gulf of Georgia and the Islands adjoining, and with the exception of the 'Watla' launch we have no other craft available for this work. This boat, however, with the officers on board, have done good work, which well justifies keeping her in commission for this branch."

The Deputy Inspector, Kamloops.

"A game-conservation was effected in this way: that, where previously there was one man acting as Game Warden, this year there were constables all over the district, and in addition I was enabled, through having a car, to cover as much ground in a week as a man on horseback would cover in a season, and in my patrols I found, in conversation with ranchers and others, that they were more than satisfied with conditions generally."

The Deputy Inspector, Fernie.

"With the exception of a few instances, the 'Game Act' throughout the whole division has been fairly observed by the citizens themselves. Thanks are due, to a great extent, to the activity of the Rod and Gun Clubs throughout the division. The police have in every instance followed instructions and have investigated complaints without delay."

The Deputy Inspector, Fort George.

"Regular patrols are carried out from time to time, and constables have been advised that game-protection forms an integral part of their duty. Ordinary patrols are supplemented by special investigations under the 'Game Act' as occasion demands. Personnel is further augmented by four duly appointed special officers resident in remote districts, remunerated only when departmentally employed."

The Chief Constable, Golden.

"Prosecutions so far have been few, owing, in a great measure, to the scarcity of men in the country. The Kootenay, which is the most important big-game area in the district, if not in the Province, has been systematically patrolled by the Wardens, and all hunters checked up as to licence, etc. Considerable difficulty has been experienced in the Kootenay, owing to bridges having been washed out by the high water last season, making fording of streams necessary and in many cases dangerous. The British Columbia-Alberta boundary has also received attention, Constable Farey having been in that section since October until driven out by snow about November 7th. During that time he worked in conjunction with the National Park Game Wardens and patrolled south as far as Kananaskis Pass."

The Chief Constable, Clinton.

"The provisions of the 'Game Act' have been strictly enforced throughout the district. The Indians are the worst offenders and are the hardest to catch, owing to the size of the sub-districts and the length of time for information to reach the police."

PROSECUTIONS.

No. of Cases.	Description of Offence.	Fines and Penalties imposed.
	January 1st, 1918, to March 31st, 1918.	
6	Game in possession during close season	$195 00
1	Venison on premises of a restaurant	25 00
1	Exceeding bag limit on deer	50 00
1	Trapping without a licence	25 00
4	Hunting wild-fowl from power-boat in tidal waters	25 00
1	Non-resident carrying firearms without a licence	50 00
1	Carrying firearms without a licence	10 00
1	Furnishing false information	25 00
4	Pump-gun not plugged	35 00
		$440 00
1	Killing grouse during close season	2 months in gaol.
1	Game in possession during close season	1 month in gaol.
3	Carrying firearms without a licence	Suspended sentence.
2	Carrying firearms without a licence	Withdrawn.
	April 1st, 1918, to December 31st, 1918.	
4	Venison in possession during close season	$ 100 00
2	Killing deer during close season	150 00
5	Killing fawns	200 00
1	Fawn in possession	25 00
5	Allowing dogs to run deer	205 00
1	Game on premises of a shop	75 00
1	Game in cold storage	5 00
1	Killing female moose	250 00
2	Moose-meat in possession illegally	20 00
1	Killing caribou during close season	250 00
12	Caribou-meat in possession illegally	60 00
2	Killing mountain-goat during close season	50 00
1	Killing bear without a licence	50 00
3	Killing pheasants during close season	125 00
1	Pheasants in possession illegally	35 00
2	Killing grouse during close season	75 00
7	Grouse in possession illegally	130 00
1	Hunting ducks during close season	5 00
1	Ducks in possession illegally	1 00
2	Hunting wild-fowl from power-boat in tidal waters	20 00
1	European partridge in possession illegally	5 00
1	Hunting illegally with farmer's free licence	5 00
1	Non-resident carrying firearms without a licence	75 00
48	Carrying firearms without a licence	365 00
1	Hunting during close season	5 00
6	Trespassing in pursuit of game on a game reserve	75 00
7	Trespassing in pursuit of game	75 00
2	Trapping during close season	350 00
1	Boy under sixteen carrying firearms illegally	5 00
3	Pump-guns not plugged	30 00
1	Carrying firearms in auto illegally	50 00
1	Refusing to stop auto	5 00
1	Furnishing false information	5 00
2	Insectivorous birds in possession illegally	20 00
		$2,901 00
3	Firearms and head-lights in possession (pit-lamping)	30 days in gaol each.
1	Removing traps legally set. (Fine $200 and one month, or three months in all, in gaol)	3 months in gaol.
1	Killing grouse during close season	2 weeks in gaol.
1	Game in possession illegally	3 months in gaol.
1	Killing deer during close season	Suspended sentence.
1	Killing mountain-goat during close season	Suspended sentence.

PROSECUTIONS—*Concluded.*

No. of Cases.	Description of Offence.	Fines and Penalties imposed.
2	Carrying firearms without a licence	Suspended sentence.
1	Carrying firearms in auto illegally	Suspended sentence.
4	Carrying firearms without a licence	Dismissed.
2	Killing deer during close season	Dismissed.
1	Caribou-meat in premises of a shop	Dismissed.
1	Killing willow-grouse during close season	Dismissed.
1	Willow-grouse in possession illegally	Dismissed.
1	Refusing to stop auto	Dismissed.
1	Permitting licence-badge to be used	Dismissed.
1	Trespassing in pursuit of game	Dismissed.
1	Using another person's licence-badge	Dismissed.
3	Hunting without a licence	Guns confiscated.
2	Pump-guns not plugged (warrants for arrest issued)	Guns confiscated.
1	Caribou-meat in possession illegally	Withdrawn.
3	Bear-meat in possession illegally	Withdrawn.
1	Carrying firearms without accompanying badge	Withdrawn.
1	Game in possession illegally	Withdrawn.
1	Trespassing in pursuit of game	Withdrawn.
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NOXIOUS ANIMALS.

Supplementary appropriations for the payment of bounty were required to dispose of the applications up to March 31st, 1918, but, as the price of coyote-pelts had greatly increased during the past few years, changes in the Bounty Regulations were introduced this year, which came into force on July 1st, 1918. Under these regulations the bounties payable are as follows:—

Each cougar .....Mature, $15 00; young, $7 50
Each timber-wolf .....Mature, 10 00; young, 5 00
Each coyote .....Mature, 2 00; young, 1 00
Each big-horned or snow owl .....

Certain restrictions were imposed with regard to the obtaining of these bounties.

In the case of wolves, the whole pelt, together with a statutory declaration, must be sent to the Curator, Provincial Museum, for verification before payment of bounty is made.

Bounty on coyotes can only be claimed on those killed in the Province west of the Rocky Mountains, and the pelts must be surrendered to the Government, together with the application for bounty, within thirty days of the date of the certificate.

Owls on which bounty is claimed must have been killed in the Electoral Districts of Comox, Alberni, Newcastle, Nanaimo, Cowichan, Esquimalt, Saanich, Islands, Richmond, North and South Vancouver, Dewdney, Delta, and Chilliwack.

The result of these regulations, as intended, was a great falling-off in the number of applications for bounty. It was obviously unreasonable for the Government to pay a bounty of $2 on coyotes when pelts of these animals were fetching anywhere from $12 to $20. At the same time, as many summer pelts are practically worthless, the opportunity was afforded for the presentation of these skins for bounty.

There have been many complaints about the increase of cougars, and it would appear to be advisable to provide a higher bounty for their destruction, with a view to encouraging people to make a more determined effort to reduce the quantity of these animals, which make havoc among domestic animals as well as game.

The Chief Constable at Fort George reports that cougar have been seen more frequently in his district than heretofore.

Dr. Gordon Hewitt, Secretary for the Dominion Advisory Board on Wild-life Protection in Canada, reported to the Game Conservation Board that the former had under consideration the effectual treatment of predatory animals, particularly in the Bridge River District. He further stated that the Advisory Board on Wild-life Protection, after going fully into the matter with the authorities of the Biological Survey of the United States Department of Agriculture,

had come to the conclusion that the bounty system will not succeed in ridding any territory of predatory animals. Certainly all evidence seems to tend to this conclusion.

Very few bounties on coyotes have been claimed, and the total amount paid for bounties since April 1st, 1918, to date represents a trifle over $3,000. This includes applications for bounties on coyotes up to July 1st, before the new regulations came into force.

The Game Conservation Board has made a recommendation, largely supported by gun clubs and private individuals, for a bounty on crows. The Chairman, writing on conditions in the Lower Mainland, says:—

"Throughout this portion of the Province crows are proving the greatest menace to our bird-life. Songbirds in this district are fast decreasing, and it is an undeniable fact that the crows' activities are increasing, and some strong efforts must be made to secure a reduction in their number."

OPEN SEASONS.

A meeting, which was widely advertised, for discussion as to the most suitable dates for the open seasons was arranged by the Game Conservation Board, and held in Victoria on July 29th, 1918. Sportsmen throughout the Province were invited to be present at this meeting or to forward to it their recommendations. A considerable number of local sportsmen attended the meeting, and resolutions were passed which were subsequently considered and largely adopted by the Board in framing their recommendations to the Executive Council, when the following open seasons were determined upon:—

Moose	Sept. 1-Dec. 15.	In Atlin, Fort George, Omineca, Cariboo, and Columbia Electoral Districts.
Caribou*	Sept. 1-Dec. 15.	Throughout the Province.
Mountain-sheep	Sept. 1-Nov. 15.	North of the main line of the G.T.P.
Mountain-goat	Sept. 1-Dec. 15.	Throughout the Province.
Bear	To June 30, '19.	Throughout the Province.
Deer†	Sept. 14-Dec. 15.	Throughout the Province.

	Northern.	Eastern.	Western.
Ducks, snipe, and plover	Aug. 15-Nov. 20	Sept. 2-Dec. 8 north of C.N.R.; Sept. 14-Dec. 15 south of C.N.R.	Sept. 21-Jan. 5 on Mainland; Nov. 2-Feb. 7 on Vancouver Island and Islands adjacent.
Geese and Brant	Aug. 15-Nov. 20	Sept. 2-Dec. 8 north of C.N.R.; Sept. 14-Dec. 15 south of C.N.R.	Sept. 21-Jan. 5 north of 51st parallel; Nov. 16-Feb. 21 south of 51st parallel.
Blue Grouse	Aug. 15-Mar. 31	Sept. 14-Oct. 31 south of C.N.R.	Sept. 14-Nov. 3.
Ruffed or willow, Franklin, and Ptarmigan grouse	Aug. 15-Mar. 31	Sept. 14-Oct. 31 south of C.N.R.	
Prairie-chicken		Sept. 14 - Sept. 21 in Grand Forks and Greenwood Electoral Districts.	
Quail		Oct. 26-Nov. 8 in Similkameen Electoral District.	Oct. 26-Nov. 26 in Esquimalt, Saanich, and Islands Electoral Districts.
Pheasants		Oct. 26-Oct. 28 in South Okanagan Electoral District; Oct. 26-Nov. 8 in Similkameen Electoral District.	Oct. 26-Nov. 26, except in Alberni and Comox Electoral Districts.
European partridges			Nov. 25-Nov. 26 in Delta and North Saanich Electoral Districts only.

Foxes	Nov. 1-Mar. 15, '19.	Throughout the Province
All other fur-bearing animals	Nov. 1-Apr. 30, '19.	North of C.P.R. and in Columbia Electoral District.
Ditto	Nov. 1-Mar. 31, '19.	South of C.P.R., including Vancouver Island and Islands adjacent.

* Except in Queen Charlotte Islands and Rainbow and Hatchie Mountains.
† Except in Queen Charlotte Islands.

The Province was divided into three zones for the purpose of conforming to the Dominion Regulations of the "Migratory Birds Convention Act," and the limitation of three and a half months' open season for wild-fowl shooting was adhered to.

The main divisional lines of the three districts were the Grand Trunk Pacific Railway separating off the Northern District, and the Summit of the Cascade Mountains dividing the Eastern and Western District, Vancouver Island comprising part of the latter.

Mountain-sheep were kept on the protected list south of the main line of the Grand Trunk Pacific Railway. No open season was allowed for grouse in the Eastern District north of the main line of the Canadian Northern Railway, or for willow-grouse in the Western District. The season for deer opened and closed throughout the Province on the same date, a measure which had long been advocated, and great care was taken by the Board in fixing the opening dates, wherever possible, to commence on a "Saturday," in order that sportsmen of every class might have an equal opportunity of getting out on the opening day.

The breeding season for game birds was an excellent one, and good sport seems to have been noted in practically all lines of shooting. The Spanish influenza is reported from many districts as having deterred hunters from making full use of the open seasons, and this applied particularly to trappers. The usual regrettable accidents, due to the careless handling of firearms, have to be reported, and one particularly distressing case occurred of two men being lost in the Malahat District (one of whom died from exposure) when comparatively close to assistance. Parties headed by the Chief Game Inspector located the survivor and subsequently the body of his companion.

Game.

Dealing with the game animals and birds in detail, the following particulars are based upon the reports received from the officers in charge of the various districts and from the Chairman and members of the Game Conservation Board:—

Moose and Caribou.—In the Atlin Electoral District moose and caribou appear to be about normal in most localities, but owing to the extreme depth of snow last winter, and the long period it stayed on the ground, the loss was considerable, beyond the slaughter by man, which was somewhat facilitated by the deepness of the snow. In the Peace River District the moose have suffered considerably at the hands of the Indians.

The Deputy Inspector at Fort George reports that during November several dead moose and caribou were discovered, which, upon examination, showed lung-trouble. Pneumonia is a common disease amongst horses in the extreme North, but it is to be hoped it will not become prevalent amongst the big game. This officer, reporting on a patrol of the Ootsa and Francois Lake District, states that moose there were very plentiful.

Moose appear to be plentiful in the northern part of the Lillooet District and are spreading into the south-eastern part. Reports about caribou are equally good, particularly in the vicinity of Barkerville. In the Columbia District moose are numerous at the headwaters of the Kootenay River.

Wapiti.—Reports from the Kootenay show that a small herd of elk is pasturing around the south end of the Elk Valley Game Reserve, and a larger herd is known to be in the vicinity of the headwaters of the White River. Reports of killing elk out of season on this reserve were investigated, and evidence found that this had taken place, but it was not possible to obtain proof against any parties, as settlers near the game reserve are very disinclined to assist, and there is little doubt that they break the law themselves from time to time. It is very necessary to station an officer in the vicinity of this reserve for at least a portion of the year.

An effort to obtain a short open season for elk, limiting the bag to the killing of one bull, was made by a few sportsmen. The request, however, was refused by the Game Conservation Board, as there had been no reports of an increase in the quantity of elk to warrant such a course, and, besides, the Board considered that after so long a closed period it would have been unfair to sportsmen then absent at the war to allow an open season.

The Elk liberated at Bridge River appear to be doing well. Two small claims for damages were paid by the Department to Indians for damage done by these animals to their crops. This is an unavoidable feature of liberating half-domesticated animals for propagation purposes, and one which has been experienced in the State of Wyoming, where the principal effort to preserve the elk has been attempted.

Mountain-sheep.—In the North the severity of last winter drove the bands to accessible spots where they became an easy prey to the Indians. In all portions of the Province where they are to be found they were reported to be somewhat scarcer. It was considered advisable by the Game Conservation Board that the season should only be open for sheep north of the main line of the Grand Trunk Pacific Railway, thus affording the Lillooet and Kootenay Districts an opportunity to recuperate.

The Chairman of the Game Conservation Board, in reporting his trip through Eastern British Columbia and Northern Alberta, wrote as follows:—

"The greatest menace to our big game is from the Indians crossing into the moose and sheep districts of East Kootenay; their method of procedure being to surround a mountain and commence what is known as a 'drive.' This means driving the game to the top of the mountain and then slaughtering everything possible. The Indians, especially the Chilcotin tribe, situated on the Fraser River near Alkali Lake, do more harm in this section in one season than all true sportsmen could do in years.

"At the junction of the Chilcotin and Fraser Rivers is a considerable area of land that has been the home of Rocky Mountain sheep for ages. Six years ago, to my personal knowledge, there were perhaps two or three hundred sheep in this section; during this visit I was creditably informed that there were not more than thirty or forty sheep in all, the Chilcotin Indians depleting the herds. I would very strongly recommend this district being made a reservation, and the whole district from Canoe Creek to Williams Lake on the east of the Fraser River, and from Gang Ranch to Chimney Creek on the west of the Fraser River, being made into an organized district, so that the Game Department can control the hunting, especially by Indians."

The regulations with regard to sheep appear to have met with approval, the only objections being from professional guides, whose interests in reality were being protected, although they may have lost a few hunting-parties for one season.

Bear.—The Game Conservation Board has recommended that the present open season all the year round for bear be terminated on June 30th, 1919, and that a short close season be effective until the fall hunting begins. Grizzlies are one of the chief attractions to many non-resident hunters, and this protection should be afforded to so valuable an asset to our big game.

Mr. A. Bannon, of Portsmouth, Ohio, whilst on a spring bear-hunt in the North, killed an unusually interesting bear, which he describes as having a full coat of long silky hair, black as coal, except on the sides, where it was a beautiful grey. It also had the usual brown markings about the face of a black bear, and the whole make-up was undoubtedly that of the ordinary black-bear species. Two or three fur-buyers pronounced it a Glacier bear.

Deer.—Successive hard winters with increasing depredation of predatory animals have materially reduced the deer in northern and middle portions of British Columbia. In the Lillooet District, west of the Fraser River, formerly one of the finest game territories, including the Yalakom Game Reserve, mule-deer have been greatly depleted by cougars and Chilcotin Indians. The latter are an annual source of trouble, and this district should be declared organized, which would assist the police in giving better game-protection here.

In the lower portion of the Province deer seem to be normal in quantity. It is increasingly difficult, however, to ascertain what number of Coast deer are killed during the open season, where hunting is easily accessible from the larger cities and towns. The Acting Chief Game Inspector reports as follows:—

"With regard to the deer, the season has been what one might call only fairly good. At one time it was fairly easy to get an estimate of the number of deer brought in, as most of them were brought in on the trains; now about 90 per cent. of the deer are brought in by automobile, which makes it impossible to get an idea of the number."

Wild-fowl—The limitation for wild-fowl shooting to three and a half months, under the "Migratory Birds Convention Act," raised serious difficulty in meeting the requirements of all districts. This especially applies to the Coast, where weather conditions greatly vary the advent of the birds. Recommendations and opinions differed radically as to what periods were best for shooting in each zone, and subdivisions of the zones fixed were found to be necessary.

In the Northern District the season was opened on August 15th, but a subsequent amendment to the Game Regulations for geese was adopted, to allow of a different period on that part of the Coast to the north of Vancouver Island, which formed part of the Western District.

Some dissatisfaction was expressed by hunters in the Comox Electoral District at the lateness of the geese season on Vancouver Island, but this season was fixed at the express wish of the sportsmen attending the open meeting.

In the Eastern District a subdivisional line was taken by the Canadian Northern Railway, the season to the south of this line opening on September 14th, twelve days after the territory to the north of it.

The Chairman of the Game Conservation Board, reporting on the wild-fowl shooting in this district, writes as follows:—

"Ducks and geese have been plentiful from Clinton to Springhouse Mountain, or all that part in Lillooet east of the Fraser River. The season there is short, really only lasting from September 15th to November 1st, as after that they leave on their southern flight; this flight passing between the Cascade and Selkirk Mountains, and then to Eastern Washington, Idaho Mountains to the Gulf of Mexico."

And referring further to the Lower Mainland:—

"Ducks throughout the entire valley of the Fraser have been very plentiful this season, affording excellent sport. The shortening of the open season under the 'Migratory Birds Convention Act,' although at first meeting with a great deal of disfavour in this Province, has proven to be of great benefit, and the sportsmen are realizing that it will be of still greater benefit from year to year. We have excellent breeding-grounds tributary to the Fraser River, and the shortening of the season will make it favourable for ducks to remain at these points undisturbed, and consequently will greatly increase the number of local birds."

An innovation was made by the Game Conservation Board in fixing the bag limit to twenty ducks per day, and, on the whole, birds seem to have been plentiful this year.

Grouse.—The Game Conservation Board, following a resolution passed by the sportsmen, recommended a close season for willow-grouse on the Western District, as the stock of birds had been reported low, even though the breeding season had been a favourable one.

All reports from the Eastern District indicate that grouse are scarcer in the Interior, despite two previous close seasons. To the south of the Canadian Northern Railway an open season was allowed for all grouse, except prairie-chicken, but the actual railway-line proved too sharp a line of demarcation, and it has been suggested that the Dominon Railway Belt be used as a subdivisional line. In the same manner the Grand Trunk Pacific Railway line affected settlers in that immediate locality. The Deputy Inspector at South Fort George comments on it as follows: "The Grand Trunk Pacific main line as a boundary demarcation between Northern and Eastern Division seems too arbitrary."

Prairie-chicken.—A short season for two weeks in the Greenwood and Grand Forks Electoral Districts was the only shooting allowed for prairie chickens. In the Interior encouraging reports have been received as to their increase. The Chairman of the Game Conservation Board, who recently visited Mr. Lawton, the Chief Game Guardian of Alberta, with a view to co-operating with him on all game matters relating to the two Provinces, states that Mr. Lawton has kindly consented to allow this Department to take what is considered necessary of both species of prairie-chicken from Alberta next spring, with a view to improving our own stock, which has been seriously reduced by too much inbreeding.

Quail.—These dainty little birds were very abundant on Vancouver Island, and a liberal bag limit, which was fixed at twenty per day, has not seriously depleted their number. Quail are also reported plentiful and doing well around the southern end of the Okanagan Valley.

Pheasants.—In allowing hen pheasants to be shot for the first time since these birds were introduced, the Game Conservation Board ultimately settled a much-discussed policy. Whilst admittedly a number of young hens have been killed, any damage in this respect to the stock has been greatly offset by the killing-off of a percentage of old hens, and thus checking inbreeding. Moreover, the pheasant is an "imported" bird, and both eggs and young birds are easily purchasable. The former bag limit of six birds per day was adhered to, with the revision that two of such birds were allowed to be hens. The Chairman of the Game Conservation Board dealing with this matter, writes as follows:—

"Pheasants were very plentiful everyhere in the Fraser Valley, and also on all Gulf Islands where land was cultivated. I have made careful investigations since the closing of the pheasant season, November 26th, with a view of ascertaining what stock is left for breeding, and I find that there are still plenty of birds, and I believe that the open season for hen

pheasants will prove highly beneficial, especially as your Department will be in a position to liberate a large quantity of new birds next summer. There is now in the pens at Oakalla quite a number of birds that will not be needed for breeding and can be liberated as soon as information is gathered as to where they are most needed."

For the first time an open season of three days for cock pheasants only was allowed in South Okanagan, where reports indicated that pheasants had been doing well and the cocks were getting too numerous. From such information as could be gathered it appears that about 100 birds were killed.

European Partridges.—In the Delta District, on the Lower Mainland, these birds are not doing so well as on Vancouver Island, and the introduction of some fresh blood is advisable. Not many birds appear to have been shot in North Saanich during the two days' open season, although they were quite plentiful both there and in South Saanich.

RED DEER.

The Game Conservation Board decided to liberate the English red deer which had been kept in captivity at the Oakalla Prison Farm since their arrival from New Zealand in the spring of 1914. During June last they were accordingly sent to Queen Charlotte Islands and turned out on the south side of Masset Inlet, where shortly after their arrival a fawn was born. The herd originally consisted of four fawns; now there are seven animals (one buck, four hinds, and two fawns).

Mr. Dunning, of Auckland, New Zealand, who kindly presented these animals in the first instance, wrote during the year saying that he would be glad to furnish another shipment of his English red deer, and as the introduction of new blood is now very important, it would be well for the Department to immediately avail itself of his generous offer. In view of the success which the introduction of these deer in New Zealand has met with, there should be little or no difficulty now in establishing them in this Province, seeing that the first consignment has proved that they can be successfully acclimatized.

NON-RESIDENTS.

In spite of a reduction in the bag limit, the number of big-game hunters in the Cassiar District exceeded that of last year. Bag limits were obtained, with the exception of mountain-goat, in almost every case by hunting-parties, which included two ladies.

It is also interesting to note that, under the new schedule of fees for big game killed, receipts averaged $203.63 per hunter in the Telegraph Creek District this year, but while the gross receipts exceeded those of last year by $380, the average of fees collected throughout the Province from each hunter amounted to only $68.03. During the previous year the licence fee under the "Game Act" was $100 for each licence.

INDIANS.

Without exception, the most difficult problem confronting the Game Conservation Board in their effort to preserve the game in the Province is to find ways and means for checking the wanton destruction of game by the Indians. Where formerly tribes had a mutual understanding as to the territory over which they should hunt, these arrangements seem to have largely lapsed, and the restraint on killing game unnecessarily, formerly self-imposed, has given away to a policy of killing all they can while it lasts. The Deputy Inspector at Fort George, on reporting on the Indians in his District, says, with a good deal of truth: "It must always be borne in mind that Indians were this country's original inhabitants, and that their descendants, not unnaturally, nourish the belief that all game is theirs and every white man's trap-line an encroachment on vested rights."

Complaints are frequent of Indians cutting beaver-dams and breaking up beaver-houses.

FUR TRADE.

The prices to which furs have increased during the past few years have drawn more attention to the valuable asset which this Province possesses in its fur-bearing animals. The sale of trappers' licences this year has increased by 400 and fur-dealers from all over the American Continent have their agents in the most convenient districts for obtaining the choicest pelts.

The Chief Constable at Fort St. George, one of the main exporting centres, states that fur to the value of approximately $300,000 was exported during the winter of 1917-18, and commenting on this remarks: "These buyers are making more from the fur than the licensed trappers, and should be made to pay for such a profitable occupation, besides giving the Department a much better idea of the fur shipped from the Province. A fur-buyer at the present time runs around the country buying fur from every one or any one, whether licensed or not."

It would appear that if the fur-trader, both resident and non-resident, were required to have a licence and report as to the fur purchased and exported, a more definite idea of our annual fur trade could be arrived at. In addition, administrative assistance would be given to this Department by having some control on outside buyers, and thereby assisting to prevent the traffic in unprime pelts caught out of season.

From the returns furnished by trappers for the season 1917-18, it would appear that there had been a general falling-off from the previous year in the number of fur-bearing animals taken, as will be seen from the following comparative list:—

	Returns from 947 Trappers, 1916-17.	Returns from 869 Trappers, 1917-18.
Beaver	7,140	5,916
Marten	5,517	5,031
Otter	236	190
Mink	2,958	2,485
Racoon	627	654
Fox	702	483
Musk-rat	15,991	13,398
Lynx	4,380	2,456
Wild-cat	88	195
Weasel	11,444	13,175
Wolverine	250	195
Fisher	641	518

FUR-FARMING.

Fox-farmers evidently have not met with much success during the past year. The following firms have reported they are discontinuing this business: W. McCullough, Pouce Coupe; W. E. Lennox, Telegraph Creek; Pacific Silver & Black Fox Co., Revelstoke; E. Haenell, Atlin; O. A. Haywood, Fort Fraser.

Owing to the remoteness of the districts in which certain farmers are located, reports have not yet been received from all of those engaged in the business.

The following is a list of fox-farms at present being operated in this Province with the number of foxes in captivity:—

Name.	Address.	Old Foxes.			Pups bred in Captivity.			Total.	Additional Foxes lost or disposed of.		
		Silver.	Cross.	Red.	Silver.	Cross.	Red.		Died.	Killed.	Sold.
Atlin Fur Farming Co.	Atlin	15	6	..	6	3	1	31	3 3½*	16	2
J. van Valkenburg	Atlin	8	..	..	1	..	..	9	3*	15	..
J. Unitus	Atlin	..	3	..	..	5	..	8	..	..	..
N. Laverdiere	Atlin	..	8	..	..	..	..	8	5†	..	..
J. L. Barker	Bickle	..	..	..	5	1	..	6	..	..	..
A. Blayner	Bickle	2	1	..	..	..	..	3	..	..	..
Landry & Demorest	Bella Coola	3	..	..	..	..	..	3	..	..	..
B. D. Tanton	Bella Coola	5	3	..	1	3	..	12	..	..	1
Homfray & Axten	Walhachin	2	3	..	3	3	..	11	..	2	..
D. Laiti	Sointula	4	2	..	..	..	..	6	..	..	..
W. McCullough	Pouce Coupe	5	2	..	..	..	..	7	1	..	..

* Litters. † Pups.

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1919.

PROVINCE OF BRITISH COLUMBIA

REPORT

OF THE

PROVINCIAL MUSEUM

OF

NATURAL HISTORY

FOR THE YEAR 1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

To His Honour Sir Frank Stillman Barnard, K.C.M.G.,

Lieutenant-Governor of the Province of British Columbia.

May it please Your Honour:

The undersigned respectfully submits the Annual Report of the Provincial Museum of Natural History for the year 1918.

J. D. MacLEAN,

Provincial Secretary.

Provincial Secretary's Office,

Victoria, March 7th, 1919.

PROVINCIAL MUSEUM OF NATURAL HISTORY,

VICTORIA, B.C., March 7th, 1919.

The Honourable J. D. MacLean, M.D.,

Provincial Secretary, Victoria, B.C.

SIR,—I have the honour, as Director of the Provincial Museum of Natural History, to lay before you the Report for the year ending December 31st, 1918, covering the activities of the Museum.

I have the honour to be,

Sir,

Your obedient servant,

FRANCIS KERMODE,

Director.

PROVINCIAL MUSEUM REPORT

FOR THE YEAR 1918.

Since the last Annual Report, although no actual field-work was undertaken, a great deal of time was devoted to the study collection in going through the specimens which have been collected from time to time and are stored in the annex. All the specimens have been rearranged, labelled, and listed, so as to make them more accessible to those who wish to consult them in the several branches of natural sciences.

In this building, which is not in any way fire-proof, is stored a very large and valuable collection of anthropological material, which, if it were to be destroyed by fire, would be impossible to duplicate; this also applies to a large number of totem-poles in the basement under this building. The older people of the aboriginal races of this Province are fast disappearing, and as the younger people do not appear to have any interest in the work done by their forefathers, it will be only a short time at the longest when all the old wood-carvings will be a thing of the past; although without doubt, in many portions of the Province, archæological specimens of the stone age may be unearthed in the vicinity of some of their old camp-sites.

This building also contains the Museum study series of bird-skins, numbering over 4,500 specimens. A number of the leading museums and ornithologists make application for the loan of specimens from time to time for comparison in determining species and subspecies, also for working out the distribution and migration of birds on this continent. The same applies to the mammal study collection, numbering nearly 1,500 specimens.

There is no way of accurately recording the number of visitors who visit the Museum during the year, as a large number of people, including children and Orientals, do not sign their names; however, a glance at the register shows that the average attendance is maintained, as over 30,500 persons having recorded their names in the book which is placed in the entrance-hall for that purpose.

It will be seen from the report on the Botanical section, written by Mr. W. R. Carter, Assistant Biologist, that Professor John Macoun, of Sidney, B.C.; J. M. Macoun, C.M.G., Chief of the Biological Division, Ottawa; Dr. C. F. Newcombe, Victoria; and others have still maintained their friendly interest in the Provincial Herbarium, by presenting specimens to fill in the gaps, principally of the Vancouver Island flora, and as Director I am pleased to say that in the Herbarium to-day there is to be found almost every plant and flowering shrub that is to be found on or recorded from Vancouver Island.

A large number of the specimens that were added this year to the Herbarium had been collected by Mr. W. R. Carter before he was appointed to the staff of the Provincial Museum.

Mr. E. H. Blackmore has continued to carry on the systematic work in the Entomological section; this work is done by Mr. Blackmore gratuitously, and he has written considerable material of interest to entomologists in this report, giving descriptions of new and rare specimens recently described or found in this Province.

A great deal of the time of the Director has been taken up with game matters during the year. I was instructed by the Attorney-General's Department to go over to Vancouver in the latter part of March, and take over the Game Department temporarily before it was handed over to the administration of the Provincial Police. This necessitated the Director being in Vancouver a considerable time each week until the offices were transferred to Victoria. The Director was also made Secretary of the Game Conservation Board by Statute, and has to give considerable of his time to that work, which is under the administration of the Honourable Attorney-General's Department.

The Director hopes that, if funds will permit this year, to carry on more scientific research in the field, so as to fulfil the object of the Provincial Museum.

Very little anthropological material was secured during the year; several small collections were offered to the Department for purchase, but owing to the fact that the appropriation was so limited and the strictest economy was to be exercised, it was thought advisable not to make any of these purchases at present. However, several good specimens of stone pestles (Nos. 3138

and 3139), also stone chisels (Nos. 3140, 3141, and 3142) and spear-points (Nos. 3143 to 3147), were collected many years ago at Port Haney, and presented by Mr. Hector Ferguson, of Vancouver, B.C., to the Provincial Museum. These specimens had been sent to the Provincial Library by mistake some time ago; however, they were finally located and transferred to this Department.

ENTOMOLOGY.

By E. H. BLACKMORE.

Very little field-work has been done during the past season, but some of the material taken by the Museum collectors during the past three years has been further worked over and many interesting facts brought to light. We have kept in touch with several of the collectors in various parts of the Province, and have obtained some new records, together with an added knowledge of the distribution of many of our species, the results of which are embodied in the following pages.

The weather conditions were vastly different to those of the previous seasons; during the last three weeks in April of this year (1918) we had a continuation of bright sunshine with a temperature far above the average, which brought about the emergence of many species far in advance of their normal times of appearance. Amongst the Geometridæ this was especially noticeable, as in many cases they were from four to six weeks earlier than usual; in one case, *Cosymbria lumenaria*, a difference of two months, a specimen being taken in fine condition on April 27th in the Lower Fraser Valley. My earliest previous record of this species is June 15th, 1915, that particular year being rather an early one. It is generally taken from the first to the middle of July.

In August we had a very wet month (I am now referring to Vancouver Island and the Lower Fraser Valley), which is very unusual, as that month is practically the hottest and driest of the whole year. A very noticeable feature of the past summer was the prevalence of high winds for continued periods, a factor which militates greatly against the collection of specimens, especially of diurnals and geometers who will not attempt to fly in the face of a strong wind.

One of the outstanding features of the season in this district was the remarkable scarcity of noctuids, this being the poorest season by far, for many years, from a collecting point of view, although in the Interior conditions did not seem quite so bad.

The damage done by cutworms this year was very light as compared with the two previous seasons; this was rather to be expected, as the season following a particularly heavy outbreak is generally comparatively light, owing to the heavy increase of parasitism amongst the larvæ and pupæ, thus enabling nature to restore her balance.

Unfortunately, to offset this, there was a very heavy infestation of the forest tent-caterpillar (*Malacosoma pluvialis* Dyar); in fact, the heaviest infestation we have had for many years. In normal years they confine themselves to the trees and bushes on vacant lots and on the roadside, but this year they were in such numbers that they attacked everything in sight, invading gardens and orchards and defoliating all kinds of fruit and shade trees. Wherever one went their ugly, unsightly webs were in evidence. A remarkable feature of the late summer was the presence all over the Province in large numbers of *Aglais californica* Bdv. (the tortoise-shell butterfly). This butterfly occurs regularly in certain sections of the Province, but I do not think that it has ever been so abundant and reported from so many widely separated localities. Mr. W. B. Anderson, Dominion Inspector of Indian Orchards, reported it from Fort George right through to Stuart Lake, all through the Cariboo and Chilcotin Districts down to Lillooet. In a letter under date of August 6th, Mr. A. W. Phair, who is a resident of the latter locality, says in part: "There is a very interesting outbreak here of what I take to be *Vanessa californica*. It is working at about 4,000 feet on a shrub with a heavy laurel-like leaf. The outbreak extends at least fifty miles in a straight line. The shrubs are all eaten off and one little branch would have about a hundred caterpillars on it."

Mr. Phair sent me some twenty pupæ, which emerged the day of their arrival, and it is curious to note that they are all about one-third less in size than the average, and, although I have specimens from all parts of the Province, these are the only dwarf ones I have seen. It may be the altitude, or, what to my mind is more probable, there was such an enormous number of them that they did not get sufficient food to eat, and consequently transformed into pupæ in a somewhat stunted state, which was reflected in the smaller size of the imagines. They also occurred from Cranbrook in the east, through the Keremeos District, down the valley of the

Lower Fraser, and all over Vancouver Island, quite a number appearing in Victoria, even invading the houses. This is the first time I have seen this species in this city during my eight years' residence here.

Another insect which was extremely prevalent throughout the same general localities as the one just mentioned was a noctuid moth (*Autographa californica* Edw.) commonly known as the alfalfa-looper. It is widely distributed in Western North America, but was only known as a pest in Canada since 1914, when a very severe outbreak occurred in this Province. It was so abundant that summer on Vancouver Island that wherever one went a score or more would fly up out of the grass at nearly every step one took. It belongs to one of the few groups of noctuid moths which fly in the daytime, and it is also attracted to certain flowers about sundown.

An important discovery of what may prove to be a serious pest was made by Mr. W. B. Anderson at Chase, B.C., in the early part of August, where one of the tussock-moths (*Hemerocampa vetusta gulosa* Hy. Edw.) was found to be devastating the Douglas fir. Further notes on this moth will be found under the heading of "Illustrated Lepidoptera."

Another interesting and important discovery, especially from an economic aspect, was the finding of the apple-maggot fly at Royal Oak, B.C., by Mr. W. Downes, Field Officer, Entomological Branch, Dominion Department of Agriculture, who is in charge of the Vancouver Island District. It has been identified by Dr. J. M. Aldrich as *Rhagoletis pomonella*. The only previous record of this fly in British Columbia is two specimens taken by Mr. R. C. Treherne at Penticton, B.C., on July 26th, 1916. Mr. Downes has also discovered that the host-plant is the common snowberry (*Symphoricarpus racemosua*) and has bred a number of flies from it. In Eastern Canada it is one of the worst of the fruit pests, but so far no signs of its attacking the apple in British Columbia have been observed.

Rare and Uncommon Insects taken in British Columbia during 1918.

In continuing this section, as was proposed in last year's report, we would like to impress upon the entomologists of this Province, especially those residing in the more outlying districts, the necessity of sending in records of their important captures, accompanied by full data, by December 31st of each year. It is only by this means that we shall get a fuller knowledge of our British Columbia species and their distribution, a knowledge which is most essential both from an economic and a taxonomic standpoint.

Victoria.—Although, as stated previously, the season was a poor one for noctuids generally, the writer has been fortunate in picking up a few species of more than passing interest.

A male specimen of *Apantesis ornata complicata* Wlk. was taken on June 16th. This pretty tiger-moth occurs regularly, but is very uncommon; three specimens in any one year in this district is the most that I have any record of.

On April 12th I took one specimen each of *Xylomyges rubrica* Harv. and *X. perlubens* Grt., at rest on an electric-light pole. These are the first records I have of these two species occurring in Victoria.

In Vancouver *rubrica* occurs regularly with *pulchella*, although much less common. *Perlubens* is plentiful at cherry-blossoms in some districts on the Mainland.

A specimen of *Trachea impulsa* Gue. was taken at light on July 6th, which is also a new record for this district; it has previously been recorded from Kaslo. Another new record for this district is *Autographa metallica* Grt., a specimen of which I took on June 21st; it occurs at Agassiz and in the Kettle Valley District. Other rare noctuids taken were *Polia variolata* Sm. and *Septis plutonia* Grt.

Amongst the Geometridæ it is interesting to note that two specimens of *Diactinia silaccata albolineata* Pack. were taken here for the first time, although I have taken it at points farther up the Island. One specimen was taken on April 30th in fine condition on a store window, and the other at rest on a fence on July 24th, thus indicating that it is double-brooded. Two specimens of *Hydriomena edenata grandis* B. & McD. were taken on electric-light poles on March 16th. They were both females, but could not be induced to lay eggs. This species is rather scarce here, although it is much more plentiful at Duncan, forty miles north of here.

Mr. W. Downes, of Oak Bay, took a nice specimen of *Polia restora* Sm. on August 3rd. This also occurs regular, but not more than one or two seem to be captured in any one year. He also took a specimen of that pretty little noctuid, *Sarrothripus revayana columbiana* Hy. Edw., on April 8th. This species seems exceedingly rare. Mr. Downes also took a geometer not previously

recorded from Victoria—viz., *Euphyia luctuata* Schiff—on June 14th; also another specimen of *Eupithecia borealis* Hulst., the first records for British Columbia of this species being mentioned in last year's Museum Report, page 12.

Mr. W. B. Anderson whilst collecting noctuids at light took a nice specimen of the peach-blossom moth (*Euthyatira pudens* Gue.). This is an exceedingly rare moth in this district. He also took a short series of *Hydriomena crokeri* Swett on April 29th. This geometer is as a rule very uncommon and is extremely local. I do not know of any other locality in British Columbia where it has been taken, and even here it seems to be restricted to one section of the city. The same collector took a single specimen of *Erannis vancouverensis* Hulst. on November 30th. This is the first record since I took a solitary specimen here on November 22nd, 1914.

Mr. W. R. Carter, Assistant Biologist of the Provincial Museum, took a fine specimen of that uncommon noctuid, *Rhynchagrotis niger* Sm., on July 15th; also a specimen of *Autographa rectangulata* Kirby, which is a new record for this district. In the Report of the Provincial Museum, 1917, p. 12, mention was made of the taking of a specimen of *Neptyia phantasmaria* Streck, which, together with one other, were the only known records from Victoria. It is interesting to note that Mr. Carter took a specimen on September 16th in Beacon Hill Park; from that time on he visited the park daily, with the result that up to October 3rd he had taken twenty-six specimens (twenty-four males and two females). It has evidently started to breed here, and as it is a pine-feeder there is no doubt but what it will become established here from now on.

My theory is that odd specimens come over on the boats from Vancouver, where it is extremely common in September. They are probably attracted by the bright lights of the ship at night at Vancouver, and settle on some portion of the rigging, flying off the next morning in Victoria, as all specimens found have been in the immediate vicinity of the sea-shore.

Goldstream.—On July 3rd the writer took a trip up Mount MacDonald, one of the mountains to the south of Goldstream, and was fortunate enough to take a couple of male specimens of *Plebeius melissa* Edw., a rather rare butterfly on Vancouver Island. I was pleased to take this, as it had been eliminated from the 1906 Check-list of B.C. Lepidoptera, and I was rather undecided as to its inclusion in a new Check-list which is in preparation.

On another trip on July 5th to Mount Braden, which is west of Goldstream, I took a geometer which at first sight seemed new to me, but later I recognized it as *Stamnoctenis morrisata* Hulst., the first specimen of which was taken at Duncan last year (*vide* Report Provincial Museum, 1917, p. 13). I went again on July 8th to the same place and succeeded in taking another one, but an extended search failed to reveal any more specimens. Both of them were males and in fine condition.

Mr. A. W. Hanham, of Duncan, also took two at light and Mr. G. O. Day took one at Maple Bay, so the species looks like it was going to become established.

Other Heterocera of interest taken by the writer at Goldstream were *Autographa mappa* G. & R.; *A. corusea* Streck; *Enypia packardata* Tayl.; and *Hyperetis trianguliferata* Pack.

Vernon.—Mr. W. Downes took a specimen of *Picris beckeri* Edw. on September 30th. This butterfly seems very uncomomn and is rare in British Columbia collections. He also took a fine specimen on May 24th of *Acronycta mansueta* Em., a rather rare noctuid, and a specimen of *Xanthorhœ ferrugata* on the same date, a geometrid which is not at all common.

Mr. M. Ruhman captured on April 26th one of our rarest arctids—*Phragmatobia fuliginosa borealis* Staud. To my knowledge there have been only three specimens taken in British Columbia—the one just mentioned, one taken by the late Captain R. V. Harvey at Vancouver on April 23rd, 1907, and one taken at Alberni, V.I., by Mr. W. R. Carter in May, 1915.

Kaslo.—Mr. J. W. Cockle has taken a specimen of *Macaria purcellata* Taylor, which is the first that has turned up since the types were taken; he has also taken *M. minorata incolorata* Dyar., which is a very rare geometer and was described from Kaslo in 1904.

NEW BRITISH COLUMBIA INSECTS.

The following twelve insects have been described as new to science during the year 1918. They comprise four species of Lepidoptera, three species of Hymenoptera, and five species of Diptera.

Lepidoptera.

In Cont. Lept. No. Amer., Vol. IV., No. 2, p. 137, May, 1918, Messrs. Barnes and McDunnough describe a new geometrid under the name of *Eustroma fasciata*, from Ketchikan, Alaska, and Cowichan Lake, Vancouver Island, B.C. The types are one male and three females, one of the females being taken in June at Cowichan Lake. This new species is closely allied to *E. nubilata* Pack, which is fairly common throughout the Province, especially the second brood in the early fall. The chief distinguishing features are that in *fascita* the antemedian white band has much more regular edges and is less bent in at the costa, also that there is no trace of any yellow shading.

Hydriomena macdunnoughi Swett is described in the Can. Ent., Vol. L., No. 9, p. 296, September, 1918, from specimens taken at Atlin, B.C., on June 11th, 1914, by Mr. E. M. Anderson. This new species bears a close superficial resemblance to *H. ruberata* Frey., but differs materially in the male genitalia. In the 1906 Check-list of British Columbia Lepidoptera, *ruberata* was erroneously listed as occurring at Kaslo; we have no authentic records of the occurrence of this species in any part of British Columbia.

Microlepidoptera.

In the Can. Ent., Vol. L., No. 7, p. 231 *et seq.*, Annette F. Brown describes several new species of Microlepidoptera, two of which are described from Field, B.C. One of them belongs to the family Yponomeutidæ and is named *Swammerdamia cuprescens*. Four species were bred from larvæ feeding from birch; they are gregarious and live in webs, pupating in August and appearing the following May. Larvæ were also taken at Glacier, B.C., feeding on alder, but for some reason or other failed to reach maturity. It is a close ally of the European *S. heroldella*, which is also a birch-feeder. The other one belongs to the family Gracilariidæ and is called *Ornix spiræifoliella*. This species is a leaf-miner and feeds on the under-side of the leaves of *Spirea sp.;* this also pupates in the fall and emerges in the following spring.

Hymenoptera.

The Ottawa Naturalist, Vol. XXXII., No. 4, p. 71, October 1918, contains a key to the species of the genus *Vespa*, occurring in Canada, by F. W. L. Sladen. In the course of his paper he describes four new forms, three of which occur in Canada and one in Alaska. The three occurring in Canada also occur in British Columbia and are as follows:—

(1.) *Vespa norvegicoides*, which has a range from Nova Scotia to British Columbia. It is closely related to *diabolica* Saus., which is our commonest wasp, and differs from it, amongst other minor details, by the yellow band on segment, one being narrower and uninterrupted; by the male antennæ being black beneath instead of testaceous; and by the hairs being longer and less dense.

(2.) *Vespa acadica*, recorded from Nova Scotia, New Brunswick, Ontario, and British Columbia; the specific localities for British Columbia being given as Kaslo and Victoria. This species makes an aerial nest and is near to *vidua* Saus., which occurs only in Ontario, as far as Canada is concerned.

(3.) *Vespa atropilosa*, described from one female and many workers. The female was taken at Lethbridge, Alta., while the workers or neuters were all taken in British Columbia, specific localities recorded being Vernon, Okanagan Landing, and Keremeos.

It is interesting to note that, out of eleven species of wasps known to occur in Canada, as many as eight of them are taken in British Columbia; these are enumerated in the following list:—

Vespa maculata Linn. This is the well-known "black hornet," which makes an aerial nest.

V. diabolica Saus. This species is found in Southern British Columbia up to an altitude of 5,000 feet.

V. norvegicoides Sladen.

V. arctica Rohw. (= *borealis* Lewis). Parasitic in nests of *V. diabolica*.

V. occidentalis Cr.

V. austriæa Pz. This a parasitic species and so far has only been recorded in this Province from Kaslo, in mid-July.

V. acadia Sladen.

V. atropilosa Sladen.

Diptera.

In the Annals of the Ent. Socy. of America, Vol. XI., No. 4, December, 1918, Mr. F. W. Pettey gives "A revision of the genus *Sciara* of the family Mycetophilidæ. In the course of his revision he describes some thirty new species from North America, two of which are from British Columbia. The first is *Neosicara lobosa*, described from one male collected at Carbonate, B.C., by a Mr. J. C. Bradley in July, 1908, at an altitude of 2,600 feet. Carbonate is situated about twenty miles south-east of Golden.

The other is *Neosciara ovata*, described from one male taken at Howser, B.C., by Mr. Bradley on June 22nd, 1905. Howser is situated on the Lardeau River about thirty-five miles north of Kaslo. It would be as well to state here that *Neosciara* is a new genus erected by Mr. Pettey, to include those species which have no setæ on the cubitus and media, and which would formerly have been placed under the old genus *Sciara*, which have setæ on these veins.

Two species of the genus *Drapetis*, belonging to the family Empididæ, are described by A. L. Melander in the Annals of Ent. Socy. Amer., Vol. XI., No. 2, June, 1918. The first is *Drapetis alternigra*, which is very widely distributed, it being found in New York, Massachusetts, Pennsylvania, South Dakota, Texas, and British Columbia. The second is *Drapetis infumata*, described from two specimens, the type specimen being taken at Nelson, B.C., on July 17th, 1910, and the paratype at Priest Lake, Idaho, on August 1st, 1915.

Sarcophaga vancouverensis Parker is described in the Can. Ent., Vol. L., No. 4, p. 122, April, 1918. This new species was described from eight specimens (seven males and one female) taken by Mr. R. S. Sherman on Savary Island, B.C., and at Vancouver, B.C., on various dates from May 12th to July 3rd, 1916.

We extend our congratulations to Mr. Sherman on his discovery of a new species, as he has done so much to advance our knowledge of the dipterous fauna of this Province.

We would like to mention an article written by Dr. A. E. Cameron (who was Dominion Field Officer in charge of the pear-thrips investigation at Royal Oak, B.C., for two years) and published in the Annals of the Ent. Socy. Amer., Vol. XI., No. 1, March, 1918. The article is entitled the "Life-history of the Leaf-eating Crane-fly, *Cylindrotoma splendens* Doane." It gives a complete account of its habits and its life-history from the egg to the image.

It is illustrated with some very fine drawings by the author, representing the larvæ and its most important parts, the pupa and the image. The larvæ of this crane-fly was discovered at Westholme, on Vancouver Island, some forty miles north of Victoria. The value of the discovery lies in the fact that this represents the first finding of the immature stages of any species of this genus on the American Continent.

ILLUSTRATED LEPIDOPTERA.

We have thought that it may be of more interest and benefit to the entomologists in various parts of the Province to describe more fully the insects illustrated in the plates contained in the Annual Reports of the Provincial Museum, and a beginning is made with those moths figured on the two plates accompanying this article. The species in the following annotated list are given in their proper scientific order, the numbers appearing before each name corresponding with a similar number in Messrs. Barnes and McDunnough's Check-list of No. Amer. Lepidoptera, February, 1917. Those with a star prefixed to them have been described since that list was published.

Noctuidæ (Plate I.).

1315. *Euxoa quinquelinea* Sm. This is a moth that has not hitherto been recorded from British Columbia. Recently, upon working over a collection of noctuids made by Mr. W. H. Danby at Rossland, B.C., some twenty years ago, I found several species that were entirely new to me. These were subsequently submitted to Dr. J. McDunnough, of Decatur, Ill., for identification, some of them proving new to British Columbia. This species is one of them; it is evidently a mountain species, as its habitat is the Sierra Nevadas of California.

E. lutulenta, which was also described by Dr. J. B. Smith at the same time (*vide* Trans. Am. Ent. Socy., XVII., p. 50, 1900), is now placed as a geographical race of *quinquelinea*. We also have a specimen of this form taken at Vernon, B.C., in 1916.

1682. *Polia negussa* Sm. This was also taken by Mr. Danby at Rossland, B.C., in 1898, and is also new to British Columbia. It was described by Smith in the Can. Ent., XXXII., August,

PLATE I.

NOCTUIDÆ AND LYMANTRIIDÆ.

Gortyna pallescens Sm.
Alberni, B.C. (W. R. Carter).
(Very rare.)

Arzama obliqua Walk.
Duncan, B.C. (E. M. Skinner).
(New to British Columbia.)

Andropolia ædon Grt.
Duncan, B.C. (E. M. Skinner).
(New to British Columbia.)

Euxoa quinquelinea Sm.
Rossland, B.C. (W. H. Danby).
(New to British Columbia.)

Ipimorpha nanaimo Barnes.
Victoria, B.C. (E. H. Blackmore).
(Very rare.)

Polia variolata Sm.
Victoria, B.C. (E. H. Blackmore).
(Very rare.)

Polia negussa Sm.
Rossland, B.C. (W. H. Danby).
(New to British Columbia.)

Autographa V-alba Ottol.
Rossland, B.C. (W. H. Danby).
(New to British Columbia.)

Hemerocampa vetusta gulosa Hy. Edw.
Chase, B.C. (W. B. Anderson).
(New to British Columbia.)

Bomolocha toreuta Grt.
Duncan, B.C. (G. O. Day).
(Very rare.)

1900, from two males and two females taken by F. H. Wooley Dod at Calgary, Alta. It is very closely allied to *segregata* Sm. and *gussata* Sm., Dr. McDunnough being of the opinion that they are probably forms of one species.

P. segregata was described from Laggan, Alta., and is recorded from Kaslo, B.C. I have a specimen of it from Sicamous, B.C. It is also a mountain form and evidently very uncommon. These two species are very much alike in maculation, *ncgussa* being more reddish-brown in colour and lacking the black markings of *segregata.*

1702. *Polia variolata* Sm. This specimen was described from Washington Territory by Smith in 1887, Proc. U.S. Nat. Mus., X., p. 467, from one male and one female. We have a specimen in the Museum collection labelled "Victoria, B.C.," and presumably taken about 1902. There is no other record of its occurrence in British Columbia that I know of until the capture of the specimen figured in the plate, on July, 1918. It must be exceedingly rare when a period of sixteen years elapses without its capture being recorded, especially in a district which is continually and regularly worked over.

2646. *Gortyna pallescens* Sm. The specimen figured was taken by Mr. W. R. Carter at Alberni, B.C., in August, 1915; one was also taken by Mr. Downes at Armstrong, B.C., on August 28th. It was also recorded in the 1906 Check-list of B.C. Lepidoptera, under the name of *medialis* Sm., as occurring at Kaslo.

In Bulletin 52, U.S. Nat. Mus., Dr. Dyar places *pallescens* as a synonym of *medialis* Sm., but in Barnes and McDonnough's new Check-list they are treated as separate, although closely allied species. In the British Columbia Check-list the name *medialis* should be eliminated, and *pallescens* substituted for it. It is interesting to note that this uncommon insect has been taken in two districts whose climatic conditions are the exact opposite of each other. Alberni being an extremely wet district, while Armstrong is in the hot dry belt.

2524. *Andropolia œdon* Grt. One specimen without date taken by the late E. M. Skinner at Quamichan Lake, near Duncan, presumably in 1896. This has not hitherto been recorded from British Columbia. Its habitat is Colorado, Nevada, and Washington. One of the types is in the British Museum.

2725. *Ipimorpha nanaimo* Barnes. This delicate ochre-coloured moth is very uncommon in this district. There is a specimen in the Museum collection taken in Victoria on August 2nd, 1898. I have no other record from here until the one I took at rest on a fence on August 18th, 1918, just twenty years later. The one in the Museum collection was determined many years ago by Dr. Smith as *plconectusa* Grt., which, although agreeing in maculation, is decidedly smaller and darker in coloration, being of a very dark fawn colour on both primaries and secondaries. The latter occurs throughout the Atlantic States, Colorado, and Utah. Mr. A. W. Hanham, of Duncan, B.C., took this latter species in Victoria many years ago, and I was fortunate enough to take one specimen in perfect condition at light on August 25th, 1916.

2784. *Arzama obliqua* Wlk. This species is new to British Columbia and was taken by the late E. M. Skinner at Quamichan Lake on June 26th, 1906. This is a very interesting record, as it is rather surprising to find it on the Pacific Coast; it is distributed over a wide area on the American Continent, from Eastern Canada south to Florida, and thence west to the Mississippi. It is a reed-feeder, the larva feeding from the top downwards until the whole of the reed is eaten out, then returning to the top and forming its pupa there. *Bellura gortynoides* Wlk. is very closely allied, and is reported from Wellington and Vancouver, although I have not as yet seen the species.

3245. *Autographa V-alba* Ottol. Taken by Mr. W. H. Danby at Rossland about the year 1900, but without specific date. This is also new to British Columbia, and was described from Wyoming by Dr. Ottolengui in Jn. N.Y. Ent. Socy., X., p. 73, 1902. It is a very pretty species and bears a strong superficial resemblance to *speciosa*, from which it can readily be distinguished by the shape of the "Y" mark.

3571. *Bomolocha toreuta* Grt. This species was referred to in the Provincial Museum Report, p. 12, 1917. In the 1906 B.C. Check-list it is reported from Cameron Lake, and one specimen was taken by Mr. R. C. Treherne at Agassiz on August 1st. This latter record would indicate that it is double-brooded, or at least partially so, as Mr. Day's specimens emerged in May from larvæ taken the previous August. The ground colour is a rich smoky brown, the white blotch in the inner margin being very striking. It occurs from New York to Texas.

LYMANTRIIDÆ (PLATE I.).

3704 (*b.*) *Hemerocampa vetusta gulosa* Hy. Edw. This moth, which has hitherto not been recorded from British Columbia, is very interesting from both a systematic and economic standpoint. It was discovered by Mr. W. B. Anderson, who is Dominion Inspector of Indian Orchards, on one of his periodical trips in the Interior. It was taken at Chase, B.C., where it was doing much damage to the Douglas fir. Imagines and full-fed larvæ were taken together on August 6th, showing it to be double-brooded. The females are wingless and live solely for the purpose of oviposition; having laid her eggs she covers them with hairy scales, which she plucks from her body and mixes them with a gummy secretion, which on drying becomes hard and brittle; as her mission in life is then ended, she dies.

The full-fed larvæ noted above spun up about August 12th, emerging in the breeding-cage on September 1st and 2nd. There are three closely allied forms—*vetusta* Bdv., described from the Coast region of California in 1852; *gulosa* Hy. Edw., described from the same general locality in 1881; and *cana* Hy. Edw., described from the Sierra Nevadas of California in the same year. After a careful comparison with the descriptions published by Neumoegen and Dyar in their "Preliminary Revision of the Bombyces of America," Jn. N.Y. Ent. Socy., Vol. II., p. 29, March, 1894, I have not the slightest hesitation in referring this British Columbia form to *gulosa*, which together with *cana* are made races of *vetusta* in Barnes and McDunnough's new Check-list. It is also a near relative of *H. leucostigma* A. & S. (the white-marked tussock-moth), whose ravages upon shade-trees and shrubbery in the Atlantic States are well known.

GEOMETRIDÆ (PLATE II.).

4002 (*a.*) *Dysstroma formosa borcata* Tayl. This is rather an interesting record, as its capture is of very rare occurrence. It was taken near Victoria by Mr. W. Downes on July 23rd, 1917. It was described in the Can. Ent., Vol. XLII., p. 87, March, 1910., from two specimens taken by Mr. T. Bryant near the Stikine River, in Northern British Columbia, on July 24th and 25th, 1905. In Barnes and McDunnough's new Check-list it is placed as a race of *formosa* Hulst., and in my opinion rightly so, as the maculation is practically the same, with the exception of the extra basal bar, which is quite distinct and perfectly black instead of red or orange.

Typical *formosa*, which was described from Colorado, also occurs in British Columbia, the writer having in his cabinet a rather poor specimen taken at Lillooet on June 23rd, 1916, and there is a specimen in the Swett collection taken by the late Mr. Livingstone at Cowichan Bay, B.C.

* *Hydriomena macdunnoughi* Swett. This specimen, new to science, is noted fully under the heading of "New British Columbian Insects."

* *Hydriomena perfracta exasperata* B. & McD. In last year's Museum Report mention was made of the new forms of *Hydriomena*, described by Messrs. Barnes and McDunnough in their revision of that group, Cont. Lept. No. Amer., Vol. IV., No. 1, May, 1917. The specimen figured is one of them and was taken by the writer near Victoria on May 19th, 1914, whilst beating for Geometridæ. It was described from two specimens, both males, one taken at Departure Bay and the other at Wellington, both localities being on Vancouver Island; it is a geographical race of *perfracta* Swett, which is taken in the Catskill Mountains, N.Y. The latter was originally described as a variety of *cærulata* Fabr. (*autumnalis* Strom), but is now considered as distinct, on account of difference in the shape of the uncus in the two forms.

4360 (*a.*) *Phasiane respersata teucaria* Stkr. This little geometrid was listed in the 1906 B.C. Check-list as *Macaria teucaria* with a question-mark; later it was determined as *respersata* Hulst., but finally it has been identified as *teucaria*, which was described from Seattle, Wash., and is really only a large form of *respersata*, whose nimotypical locality is Colorado. *Teucaria* occurs on Mount Tzouhalem, near Duncan, and although I have collected assiduously in the vicinity of Victoria for the past eight seasons, I had only taken two specimens until last May (1918), when I took thirty-seven at Mount Tolmie on May 28th. In a long series they are rather variable as regards the intensity of the markings, and also in the presence or absence of the intradiscal line; in some forms this line is present from the costa to the median vein only, giving the insect quite a different appearance. (For earlier notes on this species *see* Proc. Ent. Socy., B.C., No. 6, p. 110, June, 1915.)

4372 (*b.*) *Phasiane neptaria sinuata* Pack. Both *neptaria* Gu. and *sinuata* have been listed in previous B.C. Check-lists as occurring here, the latter being retained in the list on account

PLATE II.

GEOMETRIDÆ.

Lycia ursaria Walk.
Rossland, B.C. (W. H. Danby).
(New to British Columbia.)

Gabriola dyari Taylor.
Victoria, B.C. (E. H. Blackmore).
(Very uncommon.)

Euchlæna albertanensis Swett.
Armstrong, B.C. (W. Downes).
(New to British Columbia.)

Dysstroma formosa borcata Taylor.
Victoria, B.C. (W. Downes).
(Very rare.)

Gonodontis formosa Hulst.
Lillooet, B.C. (A. W. Phair).
(New to British Columbia.)

Phasiane respersata teucaria Streck.
Victoria, B.C. (E. H. Blackmore).

Cleora albescens Hulst.
Duncan, B.C. (G. O. Day).
(Very rare.)

Phasiane neptaria sinuata Pack.
Goldstream, B.C. (E. H. Blackmore).

Hydriomena perfracta exasperata B. & McD.
Victoria, B.C. (E. H. Blackmore).
(New to British Columbia.)

Hydriomena macdunnoughi Swett.
(Paratype male.)
Atlin, B.C. (E. M. Anderson).
(New to science.)

of its being described from one male specimen taken at Victoria by a Mr. G. R. Crotch, who collected in this district, about the year 1873. Apparently this species had disappeared, and all the specimens taken in recent years have been named *neptaria*, which was described from California.

The solution to this apparent disappearance lies in the fact that the two species are practically alike in maculation, the only difference being the larger size of *sinuata;* therefore the latter is now considered to be a northern race of *neptaria.*

Sinuata occurs right across the southern portion of British Columbia from Vancouver Island to the Rocky Mountains. The specimen figured is typical. *Neptaria* must now be eliminated from our Check-list.

4554. *Cleora albescens* Hulst. One of our very rare geometers. It was described from Seattle, Wash., by Hulst in Trans. Am. Ent. Socy., XXIII., p. 355, September, 1896. There are very few records of its capture in British Columbia. The late Rev. G. W. Taylor took it many years ago at Wellington; the late A. H. Bush took one specimen at Vancouver on May 22nd, 1902; and Mr. G. O. Day took two or three at Maple Bay, near Duncan, in August, 1911; and although it has been diligently searched for, none have been taken since. These are the only authentic records that I know of. This and *excelsaria* Strks., which was figured in Annual Report of the Provincial Museum, 1917, Plate II., were previously placed in the genus *Sclidosema;* but this genus, together with the genus *Alcis*, has been discarded, and all the species belonging to these two genera have been transferred to the genus *Cleora.*

4608. *Lycia ursaria* Walk. This is an Atlantic States species and is entirely new to our fauna; it was taken by W. H. Danby at Rossland some eighteen years ago. It was described from Albany, N.Y., in 1860, and the type specimen is in the D'Urban collection of North America Lepidoptera, which is now the property of the Entomological Society of Ontario, and is in the collection of the Agricultural College at Guelph.

4612. *Gabriola dyari Tayl.* Described from four male specimens taken in August, 1903, on Gabriola Island, opposite Nanaimo. In his description (Can. Ent., Vol. XXXVI., p. 256, September, 1904) Taylor says that it seems to be not uncommon on Vancouver Island and that he has not seen a female. It may be more common in the Nanaimo District, but it is not so in the vicinity of Victoria.

I have taken four specimens (three males and one female) in six years of collecting exclusively for geometrids. The female has the same markings as the male, but is larger, the male measuring in alar expanse 24 mm., while the female expands to 28 mm., the antennæ of the female is filiform, while the male antennæ are heavily pectinated.

4691. *Gonodontis formosa* Hulst. Taken at Lillooet on October 4th, 1917, by Mr. A. W. Phair. This species is new to British Columbia, and its capture so far north is rather unexpected, as its habitat ih Colorado and Southern California. The specimen figured is a little worn; when in a fresh condition it is evidently a rather handsome insect.

* *Euchlæna albertaensis* Swett. On looking over a collection of Lepidoptera made by Mr. W. Downes at Armstrong, B.C., a few years ago, I came across four specimens of a species of *Euchlæna* that were decidedly different to any that I had seen before. Knowing that the species going under the name of *pectinaria* Pack. in our British Columbia collection was wrongly named, I listed them provisionally as *pectinaria*, especially as they agreed fairly well with Packard's description in Mon. Geom. U.S. Geol. Survey, Vol. X., 1876. Recently in sending some material to Dr. McDunnough for identification I included one of these Armstrong specimens, and he informs me that it is *albertæensis* Swett. This new species was described in Can. Ent., Vol. 49, p. 351, October, 1917, the male type coming from Calgary, Alta., and the female type from Edmonton, Alta.

Mr. Downes's specimens comprise three males and one female, and were captured on April 25th and 30th, 1914; they are the only specimens I have seen, although I have worked over considerable material taken at Vernon and Okanagan Landing during the last three years.

Mr. Downes informs me, however, that the insect fauna of Armstrong in some respects differs very materially from that of Vernon, although the two localities are only twelve miles apart. There is more bush at Armstrong and the climate is more humid. It may be as well to state here that the moth going under the name of *pectinaria* in local collections is in reality *E. tigrinaria sirenaria* Streck.

BOTANY.

As no field-work of any description was undertaken during the season of 1918, there is little to chronicle in the Botanical section of the Provincial Museum during this period; however, the collection in the Provincial Herbarium has been materially increased and a number of specimens not hitherto in the collection have been added from the following sources:—

Additions to the collection of Professor John Macoun, received from Mr. J. M. Macoun, Chief of the Division of Biology, Geological Survey, Ottawa:—

MARSILEACEÆ.

Marsilea vestita Hook.

SALVINIACEÆ.

Azolla caroliniana Willd.

LYCOPODIACEÆ.

Lycopodium annotinum L., var. *alpestre.*
Lycopodium selago L.
Lycopodium selago var. *miyoshianum* Makino.
Lycopodium sitchense Rupr.

NAJADACEÆ.

Phyllospadix scouleri Hook.
Phyllospadix torreyii Wats.
Potamogeton pusillus L.
Potamogeton prælongus Wulf.
Potamogeton zosterifolius Schum.
Ruppia maritima L.
Zostera marina L.

JUNCAGINACEÆ.

Triglochin maritima L.

ARACEÆ.

Lysichiton kamtschatcense Schott.

ORCHIDACEÆ.

Habenaria gracilis Wats.

SAXIFRAGACEÆ.

Ribes bracteosum Dougl.
Saxifraga bongardi Presl.
Saxifraga emarginata Small.
Saxifraga integrifolia Hook.
Saxifraga mertensiana Bong.
Saxifraga rufidula Small.
Saxifraga vespertina Small.

CALLITRICHACEÆ.

Callitriche bolanderi Heg.

GENTIANACEÆ.

Gentiana sceptrum Griseb.

SCROPHULARIACEÆ.

Orthocarpus erianthus Benth.

COMPOSITÆ.

Arnica gracilis Rydb.
Artemisia suksdorfii Piper.
Cotula coronopifolia L.
Crocidium multicaule Hook.
Tanacetum huronense Nutt.

A collection of Musci from Professor John Macoun, Sidney, V.I., B.C.:—

SPHAGNACEÆ.

Sphagnum capillaceum Andrews, var *tenellum.*
Sphagnum capillaceum Andrews, var *rubellum.*
Sphagnum fuscum Von Klinggraeff.

DICRANACEÆ.

Onchophorus virens Brid.

WEISIEÆ.

Dicranoweisia cirrhata Lindb.
Dicranoweisia crispula Lindb.

CERATODONTEÆ.

Ceratodon purpureus Brid.
Distichium capillaceum Bruch & Schimp.

Pottieæ.

Didymodon rubellus Bruch & Schimp.

Grimmieæ.

Grimmia apocarpa Hedw.
Grimmia calyptrata Hook.
Racomitrium hypnoides.

Orthotricheæ.

Orthotrichum rupestre Schleich.

Bartramieæ.

Philonotis fontana Brid.
Bartramia halleriana Hedw.

Physcomitrieæ.

Funaria hygrometrica Sibth.

Bryeæ.

Bryum duvalii Voit.
Leptobryum pyriforme Schimp.
Mnium punctatum Hedw.

Aulacomnieæ.

Aulacomnium palustre Schwaegr.

Polytricheæ.

Polytrichum juniperinum Willd.
Polytrichum strictum Banks.

Hypnaceæ.

Amblystegium riparium Bruch & Schimp.
Amblystegium serpens Bruch & Schimp.
Calliergon schreberi Willd.
Camptothecium nitens Schimp.
Hypnum cristi-castrensis Linn.
Hypnum curvifolium Hedw.
Hypnum fluitans Linn.
Hypnum hamulosum Bruch & Schimp.
Hypnum lycopodiodes Schwaegr.
Hypnum uncinatum Hedw.

A small collection of grasses and plants collected in British Columbia by Mr. J. M. Macoun.

A short series from Lytton collected by Mr. W. B. Anderson. A collection of Vancouver Islands plants, approximately 650 specimens, from W. R. Carter, Assistant Biologist. This collection was made prior to Mr. Carter being appointed to the staff of the Provincial Museum, and it represents chiefly the flora of the Alberni District and illustrates the luxuriant growth of the Humid Transition area; this collection includes original specimens of a number of plants not previously recorded from Vancouver Island, together with two which are new to Canada.

These collections have been mounted by Miss H. J. Hendry, Recorder in the office of the Museum, and placed in the Herbarium of the Provincial Museum.

The following list taken from these collections are additions not previously in the collection:—

Polypodium scouleri Hook. & Grev.
Adiantum pedatum L., var. *aleuticum Rupr.*
Sparganium minimum Fries.
Lilæa subulata H. & P.
Agropyron biflorum (Brign.) R. & S.
Agropyron inerme (S. & S.) Rydb.
Agropyron tenerum Vasey.
Agrostis hyemalis (Walt.) B.S.P.
Briza media L.
Calamagrostis langsdorfii (Link.) Trin.
Danthonia californica Bol.
Danthonia intermedia Vasey.
Echinochloa crusgalli (L.) Nash.
Festuca idahœnse Elmer.
Glyceria nervata Trin.
Hierochlœ odorata (L.) Wahlenb.
Kœleria cristata (L.) Pers.
Melica bella Piper.
Melica hartfordii Bol.
Melica subulata (Griseb.) Scrib.
Oryzopsis hymenoides R. & S.
Panicum occidentale Scrib.
Carex œnea Fernald.
Carex deweyana var. *bolanderi* Boot.
Carex exsiccata Bailey.
Carex feta Bailey.
Carex flava L.
Carex lasiocarpa Ehrh.
Carex leersii Willd.
Carex phœocephala Piper.
Carex preslii Steud.
Carex pyrenaica Wahl.
Carex sitchensis Bong.
Eleocharis obtusa (Willd.) Schultes.
Juncus mertensianus Bong.
Juncus oreganus Wats.
Juncus subtriflorus Coville.
Luzula piperi (Cov.).

Allium cernuum Roth., form *alba*.
Allium crenulatum Wiegand.
Asparagus officinalis L.
Disporum smithii (Hook.) Piper.
Erythronium grandiflorum Pursh.
Sisyrinchium segetum Bicknell.
Salix hookeriana Barr, var. *laurifolia*.
Salix mackenziana Barr.
Betula papyrifera Marsh.
Alnus oregana Nutt.
Alnus sitchensis (Regel.) Sarg.
Corylus rostrata Ait.
Eriogonum subalpinum Greene.
Polygonum douglasii Greene.
Polygonum nuttallii Small.
Arenaria verna L.
Montia chamissoi (Led.) Dur. & Jack.
Coptis asplenifolia Salisb.
Platystigma oreganum (Nutt.) Benth. & Hook.
Corydalis scouleri Hook.
Subularia aquatica L.
Athysanus pusillus Greene.
Thysanocarpus curvipes Hook.
Drosera anglica Huds.
Leptarrhena amplexifolia (Sternb.) Ser.
Mitella caulescens Nutt.
Parnassia fimbriata Banks.
Saxifraga delicatula Rydb.
Saxifraga emarginata Small.
Saxifraga saximontana E. Nels.
Ribes laxiflorum Pursh.
Aruncus sylvester Kost.
Sanguisorba microcephala Presl.
Spiræa menziesii Presl., form *alba*.
Lathyrus palustris L.
Trifolium arvense L.
Vicia cracca L.
Lythrum salicaria L.
Ludvigia palustris Ell.
Myriophyllum verticillatum L.
Sanicula septentrionalis Greene.
Hypopytes.
Hypopytes.
Newberrya congesta Torr.
Vaccinium sp. deliciosum Piper.
Dodecatheon puberulum (Nutt.) Piper.
Apocynum cannabinum L.
Gilia capitata Dougl.
Myosotis ? scorpioides L.
Prunella vulgaris L., form *alba*.
Prunella vulgaris var. lanceolata form *erubescens* Fernald.
Scutellaria lateriflora L.
Solanum nigrum L.
Chelone nemorosa Dougl.
Gratiola virginiana L.
Gratiola ebracteata Benth.
Orthocarpus castilleoides Benth.
Pedicularis ornithoryncha Benth.
Boschniakia strobiliacea Gray.
Plantago major var. *minimum* Dene.
Galium trifidum L., var. *subbiflorum* Wieg.
Valerianella macrocera T. & G., a form.
Lobelia dortmanna L.
Madia glomerata Hook.
Petasites frigida (L.) Fries.
Senecio fastigiatus macounii (Greene.) Greenman.

A number of named and identified specimens of plants collected in Alaska and the islands of the Behring Sea have also been donated by Mr. J. M. Macoun, of Ottawa; these plants are a most valuable acquisition for reference and comparison with any collection made in the northern areas of this Province.

While the collection in the Herbarium is steadily growing, it is as yet far from representative of the flora of British Columbia; there are still several large areas of the Province not represented, and much new material may be looked for in the northern and north-eastern fields, and especially on portions of the mountain ranges on the west coast of Vancouver Island, where a number of plants known to occur on the Olympic Mountains, in Washington, and unknown to us, may appear.

The increase of introduced plants around our cities and railways is largely in evidence; many of these, being noxious weeds, can hardly be looked upon as a beneficial exchange for our native flora which is fast disappearing from these settled areas.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

SECOND ANNUAL REPORT

OF THE

WORKMEN'S COMPENSATION BOARD

OF THE

PROVINCE OF BRITISH COLUMBIA

FOR THE

YEAR ENDING DECEMBER 31ST

1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

THE WORKMEN'S COMPENSATION BOARD,

VANCOUVER, B.C., March, 1919.

The Honourable John Oliver, Premier,

Parliament Buildings, Victoria, B.C.

DEAR SIR,—In pursuance of section 50 of the "Workmen's Compensation Act" we enclose herewith Annual Report.

We are,

Yours very truly,

E. S. H. WINN,

Chairman.

To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Second Annual Report of the Workmen's Compensation Board of this Province is herewith respectfully submitted.

JOHN OLIVER,
Premier.

Premier's Office,
March, 1919.

REPORT OF WORKMEN'S COMPENSATION BOARD.

To the Lieutenant-Governor in Council,
Victoria, B.C.

SIR,—In accordance with the requirements of the "Workmen's Compensation Act," the following report is made. It will be divided into five parts:—

(*a.*) Financial—Assessments and Audits:
(*b.*) Claims:
(*c.*) Medical Division:
(*d.*) Accident-prevention.
(*e.*) Statistical.

(*a.*) FINANCIAL—ASSESSMENTS AND AUDITS.

All moneys paid as compensation, together with the cost of administration, are obtained by means of assessments collected from employers operating industries covered by the Act. These collections are based upon a certain percentage of the employer's pay-roll, the amount of the percentage being dependable upon the hazard of the particular industry. This percentage is known as the basic rate. This rating, however, must not be taken as indicating the true cost to the employer, for the reason that if the accidents to be paid for do not require the full amount of the basic rate, a portion only is called up.

As indicated in the statement of the condition of the classes on December 31st, 1918, the industries of the Province are grouped into a number of separate and self-sustaining classes. The industries listed in each class are, for the most part, of a somewhat similar character, either as to the nature of the work or as to the similarity of its hazards. Where two or more different kinds of industry are listed in the same class, the basic rates of assessment are in proportion to the estimated relative hazards in each industry included in the class.

Assessments are made upon the employers in each several class during each year, whenever the funds of the class in which the industry is listed require to be replenished an account of accidents which have occurred in the work of their class. In other words, assessments are not made until more funds are required.

Assessments at the basic rate for each kind of industry are based upon one-quarter of each employer's estimated annual pay-roll, and at the close of the year the true amount due from each employer is adjusted at the basic rate on as many quarters of his actual pay-roll for the year as assessments are required to be made during the year.

During the first year, in only one of the classes—namely, in Class 3—was it necessary to assess the basic rate on the entire pay-roll. In Classes 2 and 9 the basic rate was assessed on three-quarters of the pay-roll. In eight classes the basic rate was assessed on only one-half of the actual pay-roll for the year.

During the second year it was not necessary to assess the basic rate on the entire pay-roll of employers of any of the classes. In only two classes was it necessary to assess the basic rate on as much as three-quarters of the actual pay-roll, and in eight of the classes the basic rate was assessed on only one-half of the actual pay-roll for the year. In five of the classes it was found sufficient to assess the basic rate on only one-quarter of the actual pay-roll during the second year; for example, take an industry with a basic rate of 2 per cent., if but one assessment were made throughout the year the cost to that industry on its pay-roll would be one-quarter of 2 per cent., or 0.50 per cent.; if two assessments, the cost would be two-quarters of 2 per cent., or 1 per cent.

The effect of class division is that all industries in that particular class carry only the losses which occur in that class. By way of example, take the disaster which happened in No. 1 Mine of the Western Fuel Company, a company engaged in the coal-mining industry, wherein sixteen lives were lost. This company is in Class 3; the cost therefore, of that disaster is charged to Class 3 alone. No other industry placed in any other class in any way contributed to that loss; in other words, each firm in a particular class bears only its proportion of the loss in the class in which it is placed. If, however, accidents are reduced in number and severity, there is automatically a lessening of the drain on the funds of that particular class.

The question of the basic rate and its relation to cost is fully dealt with in the First Annual Report.

PENALTIES.

After the Act had been in force practically two years it was felt that employers generally had a pretty thorough understanding of its requirements; it was noted that while the large majority of the employers promptly paid their assessments, a number did not do so, the effect of which was that those who promptly paid were providing the funds to carry the accidents for all employers, while those who did not were getting the benefit of the moneys of those who had. It was therefore quite apparent that to permit this condition to continue would be unfair to those who promptly paid. For the purpose, therefore, of treating all equitably it was decided that on and after January 1st, 1919, the penalties permitted by the Act would be imposed.

Upon those failing to pay assessments within one month after the date of the assessment there is imposed a penalty of 5 per cent. of the amount unpaid on the assessment, and for each succeeding month or fraction thereof after the first month of default a penalty of 1 per cent. would be payable; in other words, default for a month or fraction thereof costs 5 per cent. of the amount unpaid, and for each month or fraction of a month thereafter an additional 1 per cent. of the amount unpaid.

Failure to pay medical-aid deductions within one month after their due dates—namely, the first days of the months of April, July, October, and January—incurs a like penalty.

The moneys received from these penalties are credited to the class in which the employer is at the time of its levy, save in the case of penalties on medical aid, in which case the penalties when collected are credited to the Medical Aid Department.

NEW CLASSES.

For the year 1918 the following new classes were created:—

Class 13: All Government employees not engaged exclusively in clerical work.

Class 14: All municipalities.

Class 15: All those engaged in fishing and packing of fish, fish or oil fertilizer, and oyster-cultivation.

Class 16 includes all those industries engaged in the manufacture of explosives, fuses, fireworks, and chemicals.

The following classes of labour not included in a named industry were extended the benefits of the Act: All school mechanics, those engaged in power-laundries not operated for a profit, and all engineers in steam-heating plants where the engineers operating are required to have a certificate or permit.

Throughout the year a number of employers not engaged in industries covered by the Act have applied to have the benefits of the Act extended to their employees. These applications were granted.

The statement of the condition of the Accident Fund on December 31st, 1918, shows the total receipts and disbursements of the Board during the first two-year period of the operation of the Act.

The average of the experience of the first two years affords a better basis for estimating the normal volume of business under the Act than would the figures for the first year. Many claims for injuries which happened during the last few months of the first year were not filed or could not be finally adjusted until the second year, and there could, of course, be no overlap of claims or serious development of injuries into the beginning of the first year from any previous period. For a similar reason the payments to the Board by employers during the second was greater than during the first year, as the true amount due in adjustment of the first year's assessment could not be ascertained and paid until their pay-rolls were audited after the close of the year.

While the volume of business during the second year was, therefore, considerably larger than during the first year, the cost to the employers for the respective years and the cost of administration did not show any material increase.

At the starting of the operations it was anticipated by the most sanguine of the supporters of this Act, and who had given the matter much thought, that by reason of the varied classes of industries and their location, some in remote parts of the Province, that the cost of transpor-

tation and the loss of time consumed in going between the different points, the cost of supplies, the increased payment of staff, that the cost to the employers would be at the best between 12 and 14 per cent. of the amount paid in by the employers for compensation.

The possibility of a high cost of operation was one of the chief objections to the measure. Two years' operation at a cost of 4.83 per cent. of the amount collected from the employer is, we believe, a sufficient answer to this objection.

The hearty co-operation which has been given by workmen, employers, and physicians, and their greater familiarity with the requirements upon them under the Act, has much facilitated the operation of every department of the work of the Board. Longer experience and a more highly perfected organization has resulted in a marked growth of efficiency of the entire staff, both in the office and in the field.

Field Auditors of the Board have visited the plants of employers in practically all parts of the Province, and as nearly as possible the pay-rolls of all employers within the application of the Act have been audited at least twice in each year.

Of every $100 collected from employers, $95.16 is used directly for the relief of injured workmen and their dependents, without any expense whatever to them, and this is only possible by reason of the Act providing for the administration of the Accident Fund by a Board appointed for the purpose, and to the exclusion of all intermediaries who might otherwise desire to make a profit out of the misery and distress of workmen injured in industrial accidents.

A reserve has been set aside and invested in Government and Victory bonds at a rate to earn 6.064 per cent., and in an amount equalling the present value of all pensions due dependents of workmen who have been killed in industry since the taking effect of the Act, and of all pensions or deferred payments due workmen who have suffered permanent partial disabilities in cases where such disabilities were not paid for in lump sums. The present value of all such pensions and deferred payments at the time the awards were made amounted to $847,024.14, of which $608,937.96 was on account of pensions payable to dependents of workmen who had been killed, and $138,086.18 on account of pensions payable for permanent partial disabilities.

Each item of reserve was figured in an amount which, earning interest at 5 per cent. and drained by the pension, would be exhausted at the end of the expectancy, to death or remarriage of the widow, or at the end of the term of any pension payable for a stated period of time.

The proceeds of 1 cent per day payable by workmen under the medical-aid provisions of the Act have gone far toward paying the expenses of physicians' treatment and hospital care in cases of accident. As expected, however, when the Act was passed, the proceeds were not quite sufficient, and it was necessary under the provision of section 30 (2) for employers, who did not have hospital arrangements with their men, approved by the Board, under section 21 (4), to make good the difference between the amount contributed by the workmen and the cost of the medical-aid service.

Two years does not afford sufficient experience to develop the true relation between the cost of physicians' treatment and hospital care to the proceeds of 1 cent per day from workmen. A number of the larger employers in the more hazardous industries, as in mining and lumbering, have approved hospital arrangements with their men, and no medical-aid charges are payable by the Board on account of any accidents which happen to such workmen.

INVESTMENTS.

During the year 1918 the Board made the following investments: $50,000 worth of Victory Loan bonds bearing interest at 5½ per cent., and $500,000 worth of British Columbia Government bonds which will net the Board 6⅛ per cent.

MERIT RATING.

It is confidently hoped that at the end of 1919 the Board may have sufficient definite statistical information as to warrant the bringing into effect of the merit-rating system as outlined in the First Annual Report, the effect of which is that those employers who by installation of safeguards and general accident-prevention measures have a record of cost less than the assessments paid will be given certain merit credits, whereas those whose accidents have cost more than their paid assessments will have a demerit differential created. Different systems of merit rating are now in effect in other places, but are still in their experimental stage. The Board has not yet decided upon any definite system, but those now in effect will be carefully investigated.

STATEMENT OF THE CONDITION OF THE SEVERAL CLASS FUNDS ON DECEMBER 31ST, 1918, COVERING FIRST TWO-YEAR PERIOD OF APPLICATION OF ACT, 1917-18.

Class.	Industries.	Received from Employers.	Refunds.	Amount paid.	Reserve, Present Value of Pensions.	Balance in Class Funds.	Rates of Assessments, Proportion of Basic Rates assessed.	
							1917.	1918.
1	Lumbering, sawmills, shingle and lath mills, pulp and paper mills, creosoting works, and logging-railways	$509,716 23	$1,176 99	$334,700 91	$173,393 44	$ 444 89	2/4	3/4
2	Lighter forms of wood-working, planing-mills, sash and door factories, etc.	30,877 48	2 83	16,060 23	11,198 68	3,615 74	3/4	2/4
3	Coal-mining	338,613 34	.....	122,856 65	216,892 24	1,135 55*	4/4	3/4
4	Metal-mining, reduction of ores and smelting, quarrying, brick-manufacturing, etc.	196,149 16	1,028 00	100,261 22	75,197 59	19,662 35	2/4	1/4
5	Iron and steel manufacturing, rolling-mills, iron or brass products, machine-shops, etc.	37,194 18	3 74	25,928 11	6,012 12	5,250 21	2/4	2/4
6	Lighter forms of manufacture, paints, shoes, flour, power-laundries, warehousing, etc.	90,364 17	598 59	45,526 49	34,922 62	9,316 47	2/4	2/4
7	Building and construction, generally, wooden or steel-ship building, pile-driving, dredging, etc.	266,258 11	35 99	137,225 59	79,116 27	49,880 26	2/4	2/4
8	Electric light and power plants, N.E.S; steam or electric railways, etc., N.E.S.; telephone or telegraph systems, N.E.S.; gasworks, N.E.S.; motion-picture machines, etc.	85,716 41	7 13	40,717 96	43,097 46	1,893 86	2/4	1/4
9	Navigation, stevedoring, wharf operation	79,694 56	196 57	40,608 57	33,912 16	4,977 26	3/4	2/4
10	Canadian Pacific Rly. and Cons. M. & S. Co. of Canada, Ltd., and their subsidiary companies	246,590 32	.....	83,058 85	90,941 03	72,590 44	2/4	2/4
11	Grand Trunk Pacific Rly. Co. and their subsidiary companies	11,112 19	.....	3,990 03	3,557 20	3,564 96	1/4	1/4
12	Canadian Northern Pacific Rly. Co. and their subsidiary companies	24,353 88	.....	9,445 33	11,986 92	2,921 63	2/4	1/4
13	British Columbia Government	34,975 31	.....	3,634 07	21,529 11	9,812 13	...	1/4
14	Municipalities	39,219 04	.....	6,377 73	33,707 04	865 73*	...	2/4
15	Canning or packing fish, fishing, fish oil and fertilizer manufacturing, kelp collecting	33,684 62	.....	7,095 59	5,480 39	21,108 64	...	2/4
16	Explosive manufacture, fireworks, fuses, chemicals, N.E.S.	12,560 91	.....	2,801 93	6,079 87	3,679 11	..	2/4
	Totals	$2,037,079 91	$3,049 84	$989,289 26	$847,024 14	$206,716 67	...	...

* Indicates debit balance.

STATEMENT OF CONDITION OF THE ACCIDENT FUND ON DECEMBER 31ST, 1918, COVERING 1917 AND 1918.

Receipts.

From employers, assessments		$2,037,079 91
From employers, medical aid		69,851 96
From interest on investments		23,205 62
		$2,130,137 49
From workmen, medical-aid dues		270,075 95
		$2,400,213 44

Disbursements.

Current—Compensation paid to workmen	$ 877,245 99
Refunds paid employers of overpayment of assessments	3,049 84
Medical Aid—Physicians, hospitals, transportation, drugs, artificial members, etc.	331,653 07
Reserve—	
Pensions paid	82,829 80
Carried forward	$1,294,778 70

Brought forward		$1,294,778 70
Value, Dec. 31st, 1918, of future payments on approved claims—		
Invested	$771,816 99	
Cash available for pensions, Dec. 31st, 1918	15,582 97	
		787,399 96
Expense (two years)	$113,043 27	
Less paid by B.C. Government, Feb. 5th, 1917	10,000 00	
		103,043 27
Cash on hand, Dec. 31st, 1918, to credit of classes		206,716 67
Cash on hand, Dec. 31st, 1918, to credit of medical aid		8,274 84
		$2,400,213 44

Ratio of net expense to total receipts from employers, 4.837 per cent.

STATEMENT OF CONDITION OF THE RESERVE FUND ON DECEMBER 31ST, 1918, COVERING 1917 AND 1918.

Present value of all deferred payments at date of approval of claims		$847,024 14
Interest on bonds		23,205 62
		$870,229 76
Pensions paid		$ 82,829 80
Invested—		
20-year 5% Debenture Bonds B.C. Government—		
December 1st, 1917	$300,000 00	
April 1st, 1918	200,000 00	
November 1st, 1918	100,000 00	
December 1st, 1918	200,000 00	
20-year 5½% Victory Loan, December 1st, 1917	25,000 00	
15-year 5½% Victory Loan, December 6th, 1918	50,000 00	
	$875,000 00	
Purchase price of bonds		771,816 99
Cash on hand, Reserve Account, December 31st, 1918		15,582 97
		$870,229 76

Average rate of interest on cost of bonds, 6.064 per cent.

STATEMENT SHOWING CONDITION OF MEDICAL AID FUND ON DECEMBER 31ST, 1918, COVERING 1917 AND 1918.

Medical aid paid by workmen at 1 cent per day	$270,075 95
Share contributed by employers	69,851 96
	$339,927 91
Physicians, hospital, transportation, drugs, artificial members, etc.	$331,653 07
Balance on hand, December 31st, 1918	8,274 84
	$339,927 91

(*b.*) CLAIMS.

The moving of the head office of the Board from Victoria to Vancouver early in the year 1918 was found to be a distinct advantage in the Claims Department, in that, being close to the large industrial operations, and in the line of travel for workmen and employers to and from all parts of the Province, a great deal of time in correspondence was saved. Further, it was very convenient to be able to deal personally with a large number of claimants.

With the experience gained in 1917, various improvements were made in the methods of adjusting claims, with a view to shortening the time necessary to make payment to the injured workmen. Additional methods were found an advantage in the speedy adjustment of claims

in necessitous cases, and the numerous letters of appreciation received from workmen whose claims had been quickly dealt with were a gratifying feature of the year's work.

During the year 1918 a total of 22,498 claims were received. This figure represents actual claims made upon the Board either for compensation or medical aid. It does not include about 4,000 minor accidents, in which the workman did not require to lay off at all and required no medical attention other than first aid rendered him; he therefore had no claim whatever under the Act. Of the total number of claims received, 22,258 were non-fatal accidents and 240 claims were fatal. During the year 8,841 claims were adjusted and made final. Some of these claims were adjusted in several monthly payments; others required quite a number of adjustments.

The average number of claims per month was 1,875. The number of unfinished claims on hand at the end of the year was 1,493, so that it will be seen that the work of the Claims Department was kept up to date. This fact is emphasized when it is considered that included in the number of unfinished claims were over 300 on which monthly payments are being made, and some of which have extended over many months, the rest of the number being new claims received within the month. As the number on hand at the end of the year was less than the average number received per month during the year, it proves that they are adjusted in whole or in part within the month. In fact, all claims are adjusted generally within five to seven days of the date on which the last report is received or the file is complete. If, therefore, an injured workman finds delay in receiving compensation, he should see to it that the doctor's progress or final report has been sent in, and if a reasonable time has elapsed since the date on which it was sent the attention of the Board should be called to the claim. Letters regarding claims receive special attention.

In this connection it may be stated that one of the most frequent causes of delay in adjustment is the workman's failure to make application for compensation. The honours for sending in first report of the accident are now about evenly divided between the employers and the doctors. It frequently happens that workmen do not trouble to send an application for compensation for some considerable time, even though they are written to by the Claims Department from one to three times and the form enclosed on which to make application. Some workmen appear to regard the compensation due to them like money in the bank, to be called for at a later date when desired. Claims on which the workman has made no application are held in suspense for one year, the workman having the right to apply within that time.

At the end of 1918 there were 883 claims in suspense. These were composed of claims in which the workmen had lost from four to ten days and had not troubled to make application for compensation, and cases where no evidence of disability had been forthcoming.

Another very frequent cause of delay in adjustment is the failure of the workman to comply with the first requisite of the Act—namely, that of notifying his employers in writing as soon as possible after the accident. It is well that an application should be made to the Board promptly if the injury is such as will disable him for more than three days.

During the year 12,631 claims were received in which the workman had not lost more than three days, and was therefore not entitled to compensation for the time lost. Medical aid, however, was allowed in these cases.

There were 403 applications for compensation which the Board could not allow, fifty-nine of which accidents did not arise out of and in the course of employment; for example, old herniæ, stepping off street-car on way to work, knocked down by automobile after leaving employer's premises, kicked by horse on way to work and not on employer's premises, etc. In 288 of these cases the applicant's disability was not the result of accident; for example, a very large number suffering from influenza, rheumatism, typhoid fever, tonsilitis, eye-strain, tuberculosis, diphtheria, venereal diseases, etc. Sixteen cases were employers who had not applied to have the benefits of the Act extended to them; in thirty cases workmen engaged in occupations which were not covered by the Act—for example, school-teaching, farmers, domestic help, etc.; four were for minor injuries attributable to serious and wilful misconduct of workmen; in two cases the accident happened outside of the Province where the workmen were neither resident nor employed within the Province; four cases were accidents which happened prior to the Act coming into effect.

No matter how wide the scope of the Act, there will always be cases that are outside the scope, and these will continue to be a source of much thought to the Board and more or less dissatisfaction among the injured parties.

From time to time the Board has received inquiries as to whether certain cases are included within the scope of the Act. They have taken the position, however, that they cannot give a decision upon a one-sided statement of a case, and that it is necessary that a claim should be filed with the Board and evidence submitted by all parties before it can be judged. This in itself accounts for quite a few of the number of claims not allowed. The validity of some of the claims was questioned even by the workmen themselves before they were submitted to the Board.

It should be borne in mind that the Act is a limited form of insurance—namely, to personal injury by accident arising out of and in the course of employment; that it does not cover all the ills to which the flesh is heir; and that there are certain disabilities which, although they may incidentally come upon the workman at the time he is engaged in ordinary occupation, are not at all due to accident, and therefore not included within the scope of the Act. The broadest possible interpretation has been given the term "personal injury by accident" consistent with fair dealing to all parties affected.

As an example of the limitations of the Act, it may be mentioned that during the severe epidemic of Spanish influenza in the fall of 1918, many inquiries, telephonic and otherwise, were made as to whether the influenza was covered by the Act, some of the inquirers claiming that it was due to their daily work. There could, of course, be only one answer to these inquiries, that the influenza, though a great misfortune, could not by any stretch of imagination be considered as an accident arising out of employment. Then, again, claims were made for such ailments as typhoid fever, scarlet fever, shingles, etc., none of which can be classed under personal injury by accident.

A total of 240 fatal accidents was reported during the year; 116 pension awards were made and many more have been allowed since the close of the year.

It is believed that had there been a little more care exercised on the part of both the employer and employee a number of these fatal accidents need not have happened. The Board has the Government's assurance that all deaths in industry caused by accident will be investigated by a Coroner's jury or some other means of searching inquiry.

Of the claims which were finally disposed of during the first two years, 456 resulted in permanent partial disability to workmen.

As shown in the statistical tables, a distressingly large number of these permanent partial disabilities were of a very serious nature—eighteen workmen each lost an arm by amputation and fifteen arms were seriously impaired; sixteen workmen each lost a leg and twenty-eight suffered permanent leg impairment; forty-six each lost the sight of an eye, and fifteen more sustained serious and permanent impairment of vision. A large number of injuries to the hand resulted in loss of one or more fingers. The greater number of these resulted from accidents in shingle-mills, but a strict enforcement of the safety regulations adopted by the Board as to the installation of safety devices has resulted in a very gratifying and marked decrease in accidents of this character.

A surprising number of workmen who met with injuries resulting in the loss of one or more fingers, or even such more serious losses as the loss of an eye, are found, within a short time after returning to work, to earn as much after accident as they did before they were injured.

In such cases, however, the Board has recognized that there has in fact been an impairment of true earning capacity, although the evidence in actual loss of wages may not yet have developed. Instead of requiring such injured workmen to report to the Board regularly for an indefinite period and making proof that any loss of wage they may have suffered was strictly on account of their physical impairment, the practice of the Board has been to estimate the probable future loss of wage which will be sustained on account of the disability during the remainder of the life of the workman, and to make final settlement at 55 per cent. of such estimated impairment of earning capacity.

Each case of permanent partial disability is carefully considered, and whenever practicable the injured man is examined by the Board, and the manner of the settlement is such as may appear to be in the best interest of each individual; except in the case of minor disabilities the awards are rarely paid in full by lump sums, but a portion of the award is paid in cash and the remainder is either paid in a life pension or in deferred payments, extending over the period during which the actual impairment of earning capacity will probably continue, and until the workman is expected to have become adapted to his disability.

In the event of an award not being satisfactory to either the employer, the workman, or his physician, a rehearing is granted, and thereupon all parties affected have an opportunity of introducing such evidence as they may feel will give the Board their view-point and possibly obtain a different decision. There have not been as many rehearings this year as in 1917. This is due, we believe, to the fact that the Act and its limitations are now better understood.

PERMANENT PARTIAL DISABILITIES.

The following cases, among others, will serve to illustrate the method adopted in dealing with permanent partial disabilities:—

Claim No. 5543.—Workman, age 54, whose right hand was seriously impaired while felling a tree. Total disability in this case continued for thirty-two weeks before claimant was able to perform lighter work. During this time compensation for 55 per cent. of lost wages and all charges for surgical treatment and hospital care were paid. It was found on questioning the workman that he had previous farming experience, and he himself felt that if a sufficient sum were advanced to him to permit him to purchase a small piece of land he would be able to make a comfortable living thereon. A sufficient sum to purchase land, as well as to stock same, was thereupon paid him. He is now engaged in raising pigs and chickens and doing small farming, and reports after a year's experience that he is doing particularly well. Fifty-five per cent. of his estmated future loss of wages were commuted into a lump sum for the purchase aforesaid.

Claim No. 7037.—Workman, age 31, whose leg had to be amputated below the knee on account of accident while employed as rigging-slinger in a logging camp. Claimant was paid compensation for thirty-three weeks and was provided with an artificial leg. Before securing employment in the woods he had earned his living by fishing. He felt that he was no longer able to work in the woods, but that if he could be paid a sufficient amount to purchase a suitable power-launch he would find no difficulty in earning a good living in the fishing industry. A satisfactory launch was purchased and a sufficient portion of his life pension was commuted for the purpose. The workman reports excellent results from such purchase.

Claim No. 4679.—Workman, age 61, whose right arm is permanently impaired as a result of scratching one of his fingers with rusty wire while employed as a longshoreman. The injury was followed by a severe attack of blood-poisoning involving the bones of the arm. His wife having had farming experience, a sufficient sum in cash was paid to enable him to buy 4 acres of well-located good land and engage in market-gardening and raising chickens. A pension of $20 per month will also be paid him for a term of years.

Claim No. 7031.—Workman, age 58, lost leg at knee as a result of a runaway while employed as a teamster. Claimant was found to have a farm, and with sufficient assistance to purchase a team of horses and wagon and other supplies he could operate it successfully, as he had become accustomed to the use of his artificial leg. He was therefore paid a sum sufficient for the purpose, and will receive a pension of $20 per month for several years.

Claim No. 2225.—Workman, age 34, the muscles of whose left arm were impaired in an accident in a mine, was given a course for a number of months in a business college, in order that he might successfully follow clerical work, and the amount of the life pension was modified accordingly.

Claim No. 17595.—Boy, age 16, who lost portions of four fingers of his right hand in a printing-machine. After consultation with his parents as to which line of instruction would be most advisable in view of the partial disability of his hand, arrangements were made for him to take a course in telegraphy, and the tuition charges will be paid in addition to payment of a monthly pension for a considerable period.

Claim No. 7125.—Boy, age 15. In this case portions of four fingers of his left hand were cut off while he was operating a rip-saw. As soon as it is determined what line of technical training will be most advisable, arrangements will be made for a suitable course of instruction.

Claim No. 20452.—Workman, age 28, lost his left arm above the elbow by being caught in the belting in a printing-office. In order that he might be qualified as an accountant, he was paid a sufficient sum in cash to maintain his family while he took such a course. It is believed that on the completion of his course he will be enabled to earn a good salary as an accountant.

With the exception of the last three mentioned cases, a committee of the unions to which the injured workmen belonged were consulted, and upon the workmen and the committees being satisfied the above arrangements were carried out. It is believed that the handling of the permanent-disability cases in this way will reasonably ensure the success of the workman's

future. The Board does not enter into these negotiations unless they are fully satisfied that the workman has had sufficient experience to make a success of the work in which he desires to engage.

Eight Chinese suffered serious permanent partial disabilities, six having lost the use of an arm or hand, either wholly or in part, and two having lost an arm. It was arranged at their request that they return to China, and on production of steamship tickets and completion of their identification and passport arrangements they were each given sufficient cash for present needs, and further payments due on their award will be paid to them in China.

Two Italians, one of whom lost an arm and the other sustained serious injury to his hand, were returned, in accordance with their own desires, to Italy, and after arrangements had been made for their transportation and passports they were given a part of their award in cash and received the balance in Italy.

Re-employment.

During the past year an earnest effort was made by the Board to find the injured workman new employment where he was unable to return to the same employment at which he was injured. In this effort the Board succeeded, with the co-operation of the workmen and employers, in finding new positions for practically all so injured.

Re "Sophia" Disaster.

On or about October 25th, 1918, the Steamship "Princess Sophia," a boat owned and operated by the Canadian Pacific Railway Company, struck a reef in Alaskan waters and went down with a crew of sixty-one, all of whom were lost. This was the most shocking catastrophe of the year. Upon the confirmation of this loss this Department immediately required the owners to report this accident in accordance with the Act's requirements. The owners thereupon notified the Board that they proposed to contest the validity of section 8 and other sections of the Act relating to this particular class of accident, taking the position that those sections were beyond the legislative authority of the Provincial Legislature. Negotiations were immediately entered into between the Board and the company to the end that there be a final and early termination of the dispute. Inasmuch as the validity of certain sections of the Act was in question, and having regard to the fact that there were a large number of dependents, some of whom required immediate assistance, and as there were difficult constitutional questions at stake, the Board appealed to the Government to appoint the best available legal assistance to push through to a speedy and successful termination the points in dispute. The Government thereupon appointed Mr. S. S. Taylor, K.C., as counsel to take charge of the matter on behalf of the Board. Action has been commenced by the company against the Board, as well as the individual members thereof. The plaintiff in the statement of claim asks for a declaration:—

"(1.) That sections 8, 9, and 12 of the 'Workmen's Compensation Act' are beyond the power of the Legislature of the Province of British Columbia to enact:

"(2.) Alternately, that the Workmen's Compensation Board is bound by and obliged to observe Part 8 of the 'Merchants Shipping Act, 1894,' or the 'Canada Shipping Act,' whichever is applicable, in respect of the payment of compensation to the said dependents:

"(3.) Alternately, that the 'Workmen's Compensation Act' is repugnant to or unworkable with Part 8 of the 'Merchants Shipping Act, 1894,' or said sections of the 'Canada Shipping Act,' whichever is applicable, in respect of the payment of compensation to the said dependents, and is therefore invalid and void:

"(4.) For an injunction enjoining the defendants and every of them from paying compensation to dependents of the crew of the 'Princess Sophia' or any of them."

The trial of the action will be held on March 10th, 1919. It is anticipated that the constitutionality of these sections of the Act will not be finally disposed of until the Privy Council hands down the final judgment, which, it is hoped, will not be later than July, 1919. In the meantime and until restrained by the Court the Board will continue to pay all those whose claims have been allowed.

Re Protection Shaft, No. 1 Mine, Nanaimo.

Another startling disaster was that which happened on September 10th, 1918, in No. 1 Mine, a property owned and operated by the Western Fuel Company at Nanaimo, whereby sixteen workmen lost their lives by the breaking of the cable between the cage and the hoisting-drum.

There was a wide difference of opinion as to what caused this breaking. In order to definitely ascertain all that could be learned on this point, the Mines Department had portions of the cable sent East to the McGill University Testing Department, supposedly the most efficient in Canada, for test. The findings of the McGill authorities were made known to the Coroner's jury, with the result that they found that there was insufficient internal lubrication, which permitted the oxidizing of the wires.

Before this report is published it is hoped that satisfactory mining legislation will have been introduced and passed as will ensure more thorough inspection, better methods of oiling, and a definite time-limit during which a cable may be used for the hoisting of workmen.

(*c.*) MEDICAL DIVISION.

The medical aid provided under the Act entitles injured workmen to all medical, surgical, hospital treatment, transportation, nursing, medicines, crutches, and apparatus, including artificial members, as are necessary at the time of the injury and thereafter during disability to relieve from the effects of the injury. It will therefore be seen that this is one of the most important departments created by the Act. Before a claim can receive consideration it must have passed through this department. All medical, hospital, nursing, drugs, dental, artificial members, apparatus, and transportation accounts have to be considered. It is believed that, in the 22,498 cases handled, approximately 75,000 medical reports and approximately 50,000 accounts were passed in connection with the past year's work.

Progress has been made in adopting various methods of reducing the number of infections which in many cases resulted seriously. In some instances slight injuries were neglected, as no first-aid treatment was given and infection was the result. It is estimated that slightly over 7 per cent. of the cases reported eventually show infection, and to overcome this, and to a reasonable extent eliminate this serious condition, the following first-aid service requirements were brought into effect at the first of this year:—

FIRST-AID SERVICE.

(1.) Every employer having more than ten and less than fifty workmen usually employed shall provide and maintain in his factory or place of employment, or in each factory or place of employment if he has more than one, a first-aid kit or box containing the following supplies, with such additional quantities as may be reasonably necessary to provide first aid to his injured workmen, and same shall be available during all working-hours without cost to them. The said kit or box shall be in charge of some suitable person.

MINIMUM FIRST-AID KIT.

A standard First-aid Manual.

Instruments.

1 pair scissors
1 pair fine tweezers.
2 eye-droppers.
1 camel's-hair brush.
1 white-enamel wash-basin.

Drugs.

2 oz. 4 per cent. boracic acid, for eye-wash.
1 (2 oz.) bottle of boracic tablets.
2 oz. alcoholic iodine, half-strength (for external use).
1 bottle, 100 tablets, bichloride of mercury.
1 (8 oz.) bottle saturated solution picric acid.
1 (8 oz.) bottle 10 per cent. Balsam-Peru in castor-oil.

Each of the above must be in bottles or containers, plainly labelled, and the specific purpose for which the contents are to be used marked thereon.

Dressings.

6 (1 oz.) packages absorbent cotton.
3 1-yard packages plain sterile gauze.
12 sterile gauze bandages (assorted sizes).
2 rolls (1 inch by 1 yard) adhesive plaster.
6 splints (assorted sizes).
2 packages raw cotton (padding for splints).

(2.) Every employer having more than fifty and less than 200 workmen usually employed shall provide and maintain in his factory or place of employment, or in each factory or place of employment if he has more than one, a first-aid kit or box containing the following supplies, with such additional quantities as may be reasonably necessary to provide first aid to his injured workmen, and same shall be available to workmen during all working-hours without cost to them. The said kit or box shall be in charge of some suitable person.

MEDIUM FIRST-AID KIT.

A standard First-aid Manual.
1 carrying-stretcher.

Instruments.

1 pair scissors.
1 pair fine tweezers.
2 eye-droppers.
1 camel's-hair brush.
2 doz. safety-pins (assorted).
1 tourniquet.
1 graduated medicine-glass.
1 porcelain or white-enamel wash-basin.

Drugs.

2 oz. 4 per cent boracic acid, for eye-wash.
2 oz. aromatic spirits of ammonia.
1 (2 oz.) bottle boracic tablets.
2 oz. alcoholic iodine, half-strength (for external use).
1 tube carbolized vaseline.
1 (8 oz.) bottle 10 per cent. Balsam-Peru in castor-oil.
1 bottle, 100 tablets, bichloride of mercury.
1 (8 oz.) bottle saturated solution picric acid.

Each of the above must be in bottles or containers, plainly labelled, and the specific purpose for which the contents are to be used marked thereon.

Dressings.

6 (1 oz.) packages absorbent cotton.
3 1-yard packages plain sterile gauze.
12 sterile gauze bandages (assorted sizes).
3 triangular bandages.
1 roll adhesive plaster (1 inch by 5 yards).
Light board material for splints.
6 assorted splints.
3 packages raw cotton (padding for splints).

(3.) Every employer having 200 or more workmen usually employed shall provide and maintain as convenient as possible to his factory or plant an emergency first-aid room, which shall be painted white and kept absolutely sanitary at all times. This room shall be kept in charge of a clerk, workman, nurse, or other person possessing a certificate of competency, to the satisfaction of this Board, to render first aid to the injured, and shall be provided with the following equipment and supplies in such quantities as may be reasonably necessary to provide first aid to the injured workmen during all working-hours without cost to them:—

FIRST-AID ROOM EQUIPMENT.

A standard First-aid Manual.

Furniture.

Hot and cold water.
1 porcelain or white-enamel wash-basin.
1 emergency operating-table.
1 sterilizer.
1 cabinet for surgical dressings.
1 porcelain or white-enamel foot-bath.
1 enamelled refuse-pail.
1 couch or bed.
1 carrying-stretcher.

A metal box or grip, fitted with emergency dressings, to be used by first-aid attendant when required to attend injured men in factory or place of employment who cannot be immediately removed to first-aid room

Instruments.

Scissors.
Dressing-forceps.
Eye-droppers.
Camel's-hair brushes.
Safety-pins (assorted).
2 steel probes.
1 silver forceps.
Tourniquet.
Graduated medicine-glass

Drugs.

Boracic acid, for eye-wash (4 per cent.).
Aromatic spirits of ammonia.
Boracic tablets.
Alcoholic iodine, half-strength (external use).
Carbolated vaseline.
Picric-acid solution.
Recognized antiseptic for washing wounds—e.g., bichloride of mercury.
Cresol.
Eusol (Dakin's solution) powder or tablet forms.
Burn-dressing—e.g., bicarbonate of soda mixed with vaseline (3 per cent.).

The above must be in bottles or containers, plainly labelled, and the specific purpose for which the contents are to be used marked thereon.

Dressings.

Absorbent cotton.
Sterile gauze.
Sterile gauze bandages (assorted sizes).
Cotton bandages (assorted sizes).
Triangular bandages.
Adhesive plaster.
Splints (assorted sizes).

(4.) Every employer employing twenty or more workmen in a place of employment situate more than five miles from the office of a medical practitioner shall at all times maintain in or about such place of employment one person possessing a certificate of competency to render first aid to the injured.

(5.) Every employer employing 100 or more workmen shall at all times have available for immediate use a satisfactory vehicle or other satisfactory means of transportation to convey all injured workmen to the nearest hospital.

(6.) Every employer employing fifty or more workmen at a place of employment more than five miles from a hospital shall provide a first-aid room and equipment in addition to the requirements mentioned in paragraph (2) herein.

(7.) Every employer shall provide immediate transportation to a hospital for all injured workmen in need of such transportation.

(8.) The foregoing requirements shall be supplied at the expense of the employer.

(9.) A minimum first-aid kit as above described, or first-aid equipment satisfactory to the Workmen's Compensation Board, shall accompany the crew in charge of every railway-train in transit and every vessel.

(10.) The Board may direct or approve of any addition to or reduction or variation in the first-aid service or appliances above described, or may in any case not above provided for prescribe such first-aid service and appliances as it deems warranted.

The number of injured workmen receiving the benefit of this medical-aid service are necessarily much greater than the number receiving lost-time compensation. All injured workmen are entitled to treatment. The Board has insisted on all workmen obtaining first-aid service, and when that is not sufficient that they go to a duly qualified medical practitioner registered under the "Medical Act." Very seldom is a claim now made by a workman who has not obtained such treatment. In the past the apparently insignificant cut or bruise was practically ignored, and the result generally was serious. The importance of antiseptic treatment of even slight wounds and for first aid in cases of emergency is now well recognized. Many thousands of dollars compensation that the Board's statistics show might have been saved by preventing blood-poisoning and other serious consequences is only a part of the benefit of such service. All employers in the Province are now required to have first-aid service outlined above. The efficiency of the service will necessarily depend much upon having it in charge of some person or persons who take an interest in the work, and who will therefore see that the equipment is correctly used and replenished when necessary. This interest should be cultivated among the employees in order that they may be able to make use of the service when the occasion does arise.

During the past two years the Board has allowed and paid for medical, surgical, hospital treatment, transportation, nursing, medicines, crutches, apparatus, artificial members, dental expense, etc., the sum of $331,653.07. It therefore can be readily seen what an important feature of the Act the medical service really is. The Board has adopted the practice that, in the event of a dispute between the Medical Referee and the physician attending the injured workman, the matter of that dispute be immediately referred to a medical man who occupies a leading position in the profession, or, in the event of there still being a doubt, the matter is invariably referred to a committee of three medical men for final decision. It is hoped by the adopting of this practice that the injured workmen as well as the attending physician will feel that every effort is being made to get the best medical opinion available.

The success of this work is due to a great extent to the energetic, enthusiastic, and hearty co-operation of practically all members of the medical profession. The feeling between the Board and the members of the profession has been most harmonious.

From a perusal of the files it would appear that one out of every twelve injuries that are suffered by the workmen where there is a three-days' time loss is a hospital case. Without exception all hospitals have most heartily co-operated with the Board, and to them also we wish to extend our appreciation.

(*d.*) ACCIDENT-PREVENTION.

Each accident prevented and each safeguard installed in an industrial establishment means not only reducing the drain on the funds, but also conserving and preserving man-power both to the Province and the nation.

COST OF INTERRUPTION AND REPLACEMENT.

The cost of interruption and replacement due to accidents is generally admitted. This is looked upon as an indefinite factor. There are many items which must enter into the establishment of definite figures, so necessarily there are many difficulties to be overcome before it can be expressed in terms of dollars and cents.

In the event of a fatal injury there is bound to be, first, a complete local paralysis of activity among the immediate workers of the injured workman. A number will naturally drop their work to lend him aid and will remain with him at least until he is delivered into the hands of the staff of the First-aid Department. After the removal of the injured workman from the scene of the accident there will be a continuance of the interruption to the regular work, during which time the witnesses of the accident will discuss it among themselves and with others who may be in the vicinity, but who did not witness it and who are very humanly interested in knowing something of the occurrence. There is also the interruption in the activities of a number of employees whose work causes them to be along the route followed in removing the injured workman to the First-aid Department or from the premises. This interruption will involve an

appreciable reduction in output among some who learn of there having been an accident only from those who have seen the injured workman while in the process of removal. Then, again, there is the workman or workmen who, by reason of being in a position of authority or responsibility, or both, will have to devote time to attending the injured workman, and later to learning something of the history of the accident. In a majority of cases, at least one fellow-workman will be detailed to accompany the injured workman, either to the hospital or his home.

Accidents which result in fatal or permanent injury or in compensable temporary injuries invariably make it necessary to replace the injured workman. There is thus involved the expense of breaking in a new man.

After giving consideration to those several items of interruption based on loss of time and to the prevailing wage, together with replacement cost, it seems entirely conservative to adopt, as some of the Boards do, the cost of interruption and replacement in a reasonably sized plant at the sum of $50 in the case of fatal injuries; the sum of $30 in permanent and serious temporary injuries; the sum of $10 in those temporary injuries which involve from one to five days' loss of time; and $5 in the case of "no time loss" injuries.

Statistics.

It is vitally important, therefore, that there be a systematic campaign of inspection of plants, depending upon the number of men employed. A portion of the work of inspection may be done by the heads of the department. A number of the larger plants in the Province consider it advisable to compile statistics covering all phases of the accident experience of the plant. These statistics showing the happening of accidents in the different portions of the plant are placed in prominent places about the plant, so that each department has an opportunity of comparing results. This work from an educational standpoint cannot fail to produce good results, as well as create a desire on the part of the different departments to establish the best record for the next month; therein the benefits of the educational work is shown.

Accident-prevention Regulations.

In the past year considerable progress has been made in organizing and conducting accident-prevention measures. Early in 1918 the following Safety Regulations were passed:—

General.

Transmission Machinery, Shafting, Couplings, Pulleys, Gearing, Belting, and Conveyors.

1. *Emergency Stopping Device.*—(Except with the consent of the Board.) Wherever there is power-driven machinery, a device shall be provided at a convenient point or points, in each department or work-room, whereby either the entire power-supply in that department or room may be cut off as a whole or the one or more lines of shafting used in driving counter-shafting or directly driving machines may be cut off independently.

2. *A Safety Placard* shall be prominently displayed, calling attention to the stopping device and method of operating same.

3. *All Safeguards* shall be well constructed and of the best material for the purpose and maintained in place.

4. *All Manufacturing Plants* shall have signal-cords connected with the bell or whistle, and located in convenient places on each floor.

5. *All Workmen* in a plant shall be taught how to make use of the system of signals by which all the machines can be stopped in case of accident.

6. *Oiling, Cleaning, and Repairs.*—Workmen shall not undertake to oil, inspect, clean, or repair machines in motion or moving parts of machinery unless previously authorized to do so by the foreman or overseer.

7. *Clothing.*—The clothing of employees having to work around moving parts of machinery, and particularly those whose duty it is to oil up and repair machines, shall be buttoned and close fitting.

8. *Gloves or Mittens* shall not be worn when handling belts when in motion, or working on machinery where they are liable to be caught in moving machinery.

9. *Handling Belts.*—No belt larger than 3 inches wide (except with the consent of the Board) shall be connected by hand unless it be slow-running. Slow-running belts shall be defined as those running less than 120 feet per minute.

10. *When a belt is not in Use* it shall be hung up in a place where it cannot be caught by pulleys or shafts.

11. *Horizontal Shafting.*—Any portion of a horizontal shaft which is 6 feet 6 inches or less from the floor or working-platform, or which may be approached while in motion, shall be guarded on the sides and bottom or protected by a standard railing ensuring at least 15 inches and not more than 20 inches horizontal clearance from the nearest moving part.

12. *Vertical Shafting.*—(Except with the consent of the Board.) Vertical or inclining transmission shafting shall be encased to a height of 6 feet from the floor.

13. *When a Shaft*, pulley, or belt passes through the floor (or any guard is placed around floor opening) a 6-inch solid section or toe-board shall be placed at the bottom of the guard, and a heavy top rail not less than 3½ feet high.

14. *Projecting Shaft Ends or Keys.*—All projecting shaft ends or keys shall be cut off or properly protected with stationary casing.

15. *Fly-wheels.*—All sections of fly-wheels with spokes which are 6 feet 6 inches or less from the floor and which are exposed to contact shall be guarded. Fly-wheels which run in pits shall be provided with handrail and toe-board around the pit.

Exception.—Where an engine is isolated in a room used exclusively as an engine-room, the fly-wheel of such engine may be guarded with a railing. This railing shall be constructed with two rails, the bottom of which shall not be less than 18 inches from the floor. Whenever main or auxiliary engines are located in a basement, they shall be completely railed or fenced off so that no unauthorized person can gain access thereto.

16. *Couplings and Collars, Keys and Set-screws.*—Shaft-couplings and set-collars shall be of a safety type, without projecting bolts, set-screws, or other dangerous projections, or be completely guarded.

17 *Clamp-couplings* shall be guarded by a cylindrical sleeve the full length of the coupling.

18. *Jaw-clutch Couplings* shall be provided with cylindrical sleeve which at least covers the jaws.

19. *Universal and Flexible Couplings* shall be so guarded or encased as to remove all hazards.

20. *Friction-clutch Couplings* shall have their operating mechanisms, where exposed, completely guarded.

21. *Keys* exposed to contact shall be made flush or guarded.

22. *Key-seats*, where exposed to contact, shall be guarded.

23. *Set-screws* or revolving parts shall be counter-sunk, or covered by a guard, or a headless set-screw shall be used. No part of the set-screw shall project above the surface.

24. *The Above Guards* shall be so designed, where practicable, as not to revolve with the part guarded.

25. *Friction-drives.*—The contact faces of all friction-drives, when exposed to contact, shall be enclosed.

26. *All Frictions* with projecting bolts shall be guarded.

27. *Bearings.*—Accurate alignment of bearings is an important factor in safety and in economy of operation. Frequent inspections of bearing and hangers are desirable. They should be so equipped with oiling apparatus that there will be no occasion for the oiler to come into dangerous proximity with shafting when it is in motion.

28. *Pulleys.*—Pulleys shall be placed at a slightly greater distance from bearings or hangers or other pulleys (except tight and loose pulleys) than the width of the belt, so that in case the belt slips off the pulley it will not become wedged between the hanger and the pulley or between the two pulleys, thus pulling down the line-shafting. If it is impracticable to space pulleys farther from a hanger or another pulley than the width of the belt, the intervening space shall be guarded in such a way that it will be impossible for the belting to become wedged should it slip the pulley. This may be done by placing a spool 4 inches larger in diameter than the pulley on the side of the pulley adjacent to a hanger or another pulley, or by use of a belt-hanger. Pulleys shall be frequently inspected for cracks which are likely to develop in the arms or rims. When a crack occurs a piece of the rim may be thrown out by centrifugal force and cause a serious accident. Testing by hammer will usually disclose any defects.

29. *Idler Pulleys or Tighteners* used to tighten belts on pulleys, if provided with counter-weights, shall have counter-weights guarded or enclosed.

30. *Belt-shifters.*—A permanent belt-shifter shall be provided for all loose pulleys, and shall be located within easy reach of the operator. The construction of belt-shifters shall be such as to make it impossible for the belt to creep back on to the tight pulley. All belt-shifters shall be equipped with a lock or some other device to prevent accidental shifting.

31. *Belts.*—All belts, ropes, or chain-driving machinery or shafting, and all secondary belts, ropes, or chains, where exposed to contact, shall be guarded. In all cases the point where the belt, rope, or chain runs on to the pulley sheave or sprocket, if within 6 feet 6 inches of the floor or platform, shall be guarded.

Exception.—Belts which are so small that they are not in any way a source of danger.

32. *All Horizontal Belts, Ropes, or Chains* driving machinery or shafting 6 feet 6 inches or less above the floor or platform, where exposed to contact, must be guarded. All overhead belts 6 inches or more in width and over 6 feet 6 inches from the floor or platform shall be guarded underneath and on sides, unless so guarded that persons cannot pass under them. All chains or rope-drives over 6 feet 6 inches from the floor or platform shall be guarded in like manner to belts over 6 inches in width In all cases the guard should cover the outer faces of the two pulleys or sheaves and extend upward to such a point and be attached in such a way that, in case the belt, chain, or rope breaks, the guard will withstand the whipping force.

33. *Vertical and Inclined Belts* shall be substantially guarded as follows: If the guard be less than 15 inches from the belt, there shall be a complete enclosure of wood or metal to a height of 6 feet, unless it is a small belt, then with the permission of the Board a small belt-guard need only be 3 feet 6 inches high. If the guard is placed at least 15 inches clearance from the belt, a two-rail railing at least 3½ feet shall be required.

34. *Belt-tighteners* which control the operation of machines shall be equipped with a safety lock or stop which will prevent the application of the tightener to its belt until the lock or stop is released.

35. *Transmission Gearing.*—In this term is included all forms of spur-gears, pinions, bevel-gears, mortise-wheels, and sprockets for chain-drives, etc. Such gearing, wherever located, shall be strongly and completely encased, or when this is impracticable shall have a band guard provided with side flanges extending inward beyond the root of the teeth. Where there is a spoke hazard the gears always shall be enclosed on exposed side.

36. *The Operation of Driven Pulleys* on line or counter-shafts which have no bearing between the pulley and the end of the shaft shall not be used unless guides be provided which will prevent the belt running off the pulley.

37. *Runways.*—If possible, overhead runways shall not be less than 20 inches in width and equipped with a handrail. If runway is less than 20 inches in width, then same shall have two handrails. Access to these runways shall be in all cases by means of fixed ladders or railed stairways.

38. *If a Passage or Runway* passes between the strands of a belt, a substantially covered way with railed sides or other adequate guard shall be provided.

39. *If a Passage or Runway* passes over a shaft or conveyor, a substantial covered way with sides shall be provided.

40. *Ladders.*—All movable ladders (except substantial step-ladders) shall be provided with either sharp points at the foot or wide rough surface feet or other effective means to prevent slipping. Ladders for use in oiling overhead shafting, where necessary to rest same on the shafting, shall be arranged to hook over the shafting. Ladders shall extend at least 2 feet above top of landing.

41. *Stairways and Handrails.*—All stairways shall be equipped with handrails, and the rails shall be kept smooth and free from nails and splinters.

42. *Where the Stairway* is not built next to a wall or partition, rails shall be provided for both sides.

43. *Floor Openings* shall not be allowed without guard-rails and toe-boards without written permission from the Board.

44 *Floor Platforms and Wharves*, etc., shall be kept in good repair and free from nails and other debris.

45. *Where* timber, lumber, slabs, rock, or refuse is dropped from mill floor to lower floor or ground, the space where it is dropped to shall have a railing so as to prevent any person from walking under said opening.

46. *Emery-wheels, Hoods, and Guards.*—Emery-wheels used for grinding purposes shall be equipped with a hood connected with an exhaust-fan or water system. A guard shall be provided as a part of the hood-construction or in addition to the hood, which shall be strong enough to withstand the shock of a bursting wheel. This guard shall be adjusted close to the wheel and extend over the top of the wheel at a point 30 degrees beyond a vertical line drawn through the centre of the wheel. The exhaust or water system is not required on emery-wheels which are in general use by all employees in common to touch up castings or tools.

47. *Arbor Ends* shall be guarded.

48. *Speed of Wheel* shall not exceed the speed guaranteed by the manufacturer or determined by the Inspector.

49 *Goggles* shall be supplied for workmen while working at emery-wheels, or the guard shall be equipped with an extension guard with steel frame and heavy glass to prevent sparks striking workmen in the eyes. Celluloid frame goggles shall not be used.

50. *Passage-ways and Platforms.*—Whenever it is possible, thoroughfares through basements shall be avoided. If not possible to avoid this altogether, any passage-way that may have to be used as a thoroughfare shall be properly protected and lighted.

51. *Tanks.*—The supports of all elevated tanks shall be accessible for the purpose of inspection. Every tank over 7 feet deep containing liquids shall have a fixed ladder both inside and out. Rungs shall have a clearance of at least 6 inches.

52. *Hogs and Grinders* shall be properly guarded, so that it is impossible for knots, chips, etc., to fly out and injure workmen.

53. *When it is necessary* for workmen to pass under bearings, said bearings shall be equipped with drip cups or pans securely fastened in position, so as to prevent oil from falling on floor.

54 *Where* iron or steel scrap is broken up with drop-weight, the said area shall be completely enclosed on sides 8 feet high, to prevent injury to workmen from flying pieces.

Scaffolds.

1. *Scaffolds* in particular shall receive the most careful attention as to strength and rigidity.

2. *All Scaffolds* shall be kept in the best of repair and all broken or rotten timbers or boards removed.

3. *The Piling* of excessive weights or concentrated loads which might cause collapse of the scaffold shall at all times be avoided. Where scaffolds are over 10 feet above the ground or floor, they shall, where practicable, be equipped with a railing and toe-boards or skirting-boards to prevent falling material. On suspended scaffolds, where practicable, it shall be necessary to use wire rope for slings and stirrups.

4. *Floor Openings* shall not be allowed without guard-rails and toe-boards, unless by permission of Inspector.

Cranes.

Safety Standard for Cranes.

Factor of Safety for all parts other than gears, and complete hoist mechanism, 5.

Factor of safety for brakes, 15.

Floorman to warn people out of the way.
Floorman or Hoistman to be provided with megaphone or gong.

SAWMILLS.

1. *Log-hauls.*—(*a.*) For chain-hauls the return strand of the chain in the basement shall be so supported over passage-ways that in the event of its breaking it cannot fall on any one beneath.

(*b.*) Unless clearly impracticable, every log-haul shall have at least one runway of sufficient width to enable a person to stand clear of logs in the chute.

(*c.*) Runway shall be equipped with handrail.

2. *Log-deck.*—Provisions shall be made at the mill end of the log-deck to afford substantial protection from rolling logs to the sawyer and other employees who may be engaged around the band or circular mill.

3. *Carriage.*—(*a.*) When a log-deck is equipped with a steam-operated nigger, carriage-knees shall be equipped with goose-necks or straight bar extending 18 inches or more above top of knee.

(*b.*) The seat or stand of the setter shall be fitted with an adequate protection to prevent his coming in contact with the wall timbers or rafters where the clearance between the back of the setter's seat and the wall timbers of the mill structure is less than 18 inches.

(*c.*) There shall be placed at each end of the carriage-travel a substantial buffer-stop, preferably equipped with spring or pneumatic buffers.

(*d.*) Means shall be provided for securely locking the sawyer's log-turning and carriage-control levers.

4. *Band-mills.*—(*a.*) All band-mills and band resaws shall be adequately protected when running.

(*b.*) Every band-mill wheel shall be carefully inspected at least once a month, and all hubs, spokes, rims, bolts, and rivets subjected to hammer tests and examined thoroughly.

(*c.*) Every band-mill shall be equipped with a saw-catcher or rest of substantial construction.

(*d.*) Opening above band-mill into filing-room shall be boxed and covered, with a cross-bar to lock same.

5. *Band Resaws.*—(*a.*) These shall have gears covered on feed-rolls and shall have a sufficiently heavy board up in front to catch the blow in case saw should break.

(*b.*) Guards shall be installed to cover both upper and lower wheels of all band resaws.

(*c.*) The up-travel shall be completely guarded, and the down-travel shall be guarded with a shield extending down to the guide.

6. *Circular Saws.*—(*a.*) A screen of wire cloth or other suitable device shall be so placed on circular-saw mills as to protect the sawyer from flying particles.

(*b.*) Circular-saw mills shall be equipped with safety guides, which will admit of adjustment without the use of a wrench or other hand-tool.

7. *Edgers.*—(*a.*) There shall be a screen of wire cloth or wood both back and front of the edger to prevent flying knots, chips, etc., or the top of the edger must be completely covered over.

(*b.*) Bench- or single-saw edgers shall be equipped with splitter and saw-guard.

8. *Live Rolls.*—(*a.*) All live-roll gears shall be guarded on the top, bottom, and sides.

(*b.*) Driving-shafts of live rolls shall be guarded on top and sides.

9. *Jump-saws.*—Jump-saws shall be guarded below the top of the roll and a stop shall be provided which will prevent any timber from being thrown off the live-roll case and on to the carriage-track.

10. *Swing-saws.*—All swing-saws shall have guard over front and safety stop to keep them from swinging out too far.

11 *Slashers.*—Slasher-saws shall be guarded front and back.

12. *Trimmers.*—A guard shall be provided in front of all trimmer-saws unless the method of control is such that no employee is required to stand in direct line with any saw while it is cutting, and in the case of overhead trimmers, where the duties of employees require them to stand in the rear of the trimmer-table, a guard shall be provided in the rear of the saws.

13. *Conveyors.*—(*a.*) When the return strands of conveyors operate within 7 feet of the floor, there shall be a shallow trough provided of sufficient strength to carry the weight resulting from a broken chain.

(*b.*) If the strands are over 7 feet from the floor, a means shall be provided to catch and support the ends of the chain in the event of a break over passage-ways or runways.

LATH-MILLS.

Lath-bolters.—The gears and sprockets of lath-bolters shall be fully guarded and the feed-chains shall be guarded to as low a point as the maximum height of the stock will permit.

Lath-machines.—The feed-rolls, saws, gears, sprockets, and chains of lath-machines shall be guarded.

SHINGLE-MILLS.

1. *Vertical Shingle-saws.*—With the exception of that portion against which the stock is fed, the shingle-saws shall be guarded. To make provision for the clearing of waste from the saw, it is permissible to leave the periphery of the saw open, provided that the guards shall extend not less than 6 inches beyond the point of the saw-teeth.

2. *Clipper-saw.*—(*a.*) A guard over saw shall be maintained at all times.

(*b.*) Clipper-boards shall be equipped with finger-guards.

3. *Shingle-jointers.*—The front or cutting face of knife-type shingle-jointers shall be fully guarded, with the exception of a narrow slot through which the shingles may be fed against the knives.

4. *Power-bolters.*—These shall have spreader behind saw and railing of standard size around carriage-track from front of saw.

5. *Pinion-gears.*—These shall be covered on all shingle-machines.

6. *Drag-saws.*—All gears and frictions on drag-saws shall be guarded.

7. *Fly-trips.*—Fly-trips shall not be used on shingle-machines.

WOOD-WORKING.

1. *Machines with Knife-heads.*—All knife-heads of wood-shapers and similar heads of other machines not automatically fed shall be guarded, or forms shall be used in which the part operated on is securely fastened. All knife-heads of wood-working machines which are automatically fed, such as stickers, planers, etc., when exposed to contact, shall be guarded.

2. *Wood-jointers.*—All wood-jointers shall be equipped with cylindrical cutter-heads of safety type. A suitable automatically adjusted guard shall be placed over the whole cutting-space in the table.

3. *Sanding-machines.*—Disk sanders shall have the circumference and back of the revolving head thoroughly guarded. Belt-sanders shall have both pulleys enclosed.

4. *Jump-saws.*—To prevent any one from approaching too near saw from back, jump-saws shall have railing.

5. *Swing-saws.*—All swing-saws shall have guard over front and safety stop to keep them from swinging out too far.

6. *Cut-off Saws.*—These shall rest in hood when idle.

7. *Table Rip-saws.*—These shall have spreader behind them and hood over top.

8. *Revolving Cut-off Saws.*—These shall be boxed beneath table so they cannot be reached without removing cover.

9. *Band-saws.*—(*a.*) These shall have gears covered on feed-rolls and shall have heavy board up in front to catch the blow in case saw should break.

(*b.*) Guards shall be installed to cover both upper and lower wheels of all band-saws.

(*c.*) The up-travel of all band-saws shall be completely guarded, and the down-travel shall be guarded with a shield extending down to the guide-rolls.

LAUNDRIES.

1. *Flat-work Ironers.*—A feed-roll guard shall be provided for all flat-work ironers and kept in good working-order.

2. *Collar and Cuff Ironers.*—All collar and cuff ironers shall be equipped with guards in front of the first rolls to prevent the hands of the operator from being drawn into the rolls.

3. *Body-ironers.*—Asbestos shield over heated roll shall be provided for all body-ironers, same to act as a guard for upper portion of roll. All body-ironers installed hereafter shall have finger-guards.

4. *Handkerchief-mangle* shall have guard for feed-roll.

5. *Extractors.*—All extractors shall be provided with cover, same to be kept closed when machine is in operation.

6. *Washing-machines.*—All washing-machines and tumblers shall be equipped with brakes and lock or other device to prevent the inner cylinders from moving during the loading and unloading process.

7. *Belting.*—Whenever women are liable to come in contact with belting, it shall be guarded so as to prevent it from attracting their dresses or hair.

8. *Pulleys.*—All pulleys and gears shall be guarded in such a manner as to prevent women's aprons or dresses from being caught.

ELEVATORS.

1. *Elevator Catching Device.*—All elevators, except direct-lift plunger elevators, shall be equipped with an automatic device to catch the car in case it drops.

2. On catching devices to which speed-governors are attached, the dogs or clamps of such catching device shall be attached to the under-side of the car platform.

3. All power-driven elevators shall be provided with automatic stops which shall stop them at the lowest and at the highest landings, independent of the operating cable or other device.

4. Safety devices shall be tested for efficiency at least once a month, and a record thereof kept for inspection by the Board or its Inspectors.

5. *Freight-elevator Gates.*—(Except with the consent of the Board.) At each landing gates shall be self-closing and not less than 5½ feet in height, except at top landing, where such gates shall not be less than 3½ feet in height. The bottom rail on all gates shall be not more than 12 inches from the floor.

6. In case local conditions do not permit of a gate 5½ feet in height, a gate not less than 3½ feet in height may be used, provided such gate is placed not less than 12 inches from the platform of the car, and provided that tell-tale chains not less than 4 feet long and not over 5 inches apart are suspended from the edge of the platform in front of opening.

7. *Elevator-shafts—Projecting Floors, etc.*—All projections in shaft, such as floors, beams, sills, unless guarded against by the car enclosure, shall be provided with smooth bevelled guards, fitted directly under such projection so as to push any projecting portion of the body back into the car instead of crushing it. This bevelled guard shall be set at an angle of not less than 60 degrees with the floor-level.

8. *Freight-elevators—Enclosure of Car.*—(Except with the consent of the Board.) All freight-elevator cars shall be enclosed solidly on all sides except on entrance side to a height of not less than 6 feet. On side of the operating cable sufficient space shall be allowed to operate the cable.

9. All elevator-cars except sidewalk elevators shall be equipped with a covering over the top; this to be made solid or of wire screen, and shall be not less than No. 10 wire and with mesh net over 1 inch. On freight-elevators the part of such covering which faces the opening to the shaft shall be constructed with a section of not less than 18 inches in width and extending the width of the opening to the shaft. Such section shall be attached with hinges to the screen, so that it will rise when it meets with an obstruction as the car descends.

10. *Shipper-rope Locks.*—All power-driven freight-elevators controlled by shipper-ropes shall be provided with lock, so arranged that the car can be locked at each landing.

11. *Machine Slack-cable Safety Device.*—Slack-cable devices, which will stop the elevator machines if the hoisting-cables slacken or break, shall be provided on all winding-drum power elevators having a travel of over 15 feet.

12. *Signals.*—There shall be a bell located in every power-driven freight-elevator or in the shaftway where it may be heard on all floors, and so arranged as to be operated from each landing.

13. *Mechanical Devices* shall be kept clean and free from excessive grease and dirt.

14. *Cables* shall be renewed when, through broken wires, wear, undue strain, or other conditions indicating deterioration, they are considered unsafe.

15. *Overhead Sheaves.*—Where the overhead machinery consists only of sheaves, a metal grating or screen shall be placed under such sheaves and extend over the entire shaftway and give safe access to the sheaves from the floor or roof of the building. The grating or screen shall be of sufficient strength to sustain a load at centre of span of not less than 500 lb., with a factor of safety of 4. The openings in such gratings or screen shall not be wider than 1 inch.

PENALTY.

Every person who contravenes any of the aforesaid regulations shall be liable to a penalty of $50.

Accident-prevention measures have not only meant fewer injuries and consequently less suffering and distress to workmen and their families, but has increased the efficiency of the plant's operation, so economic gain has followed.

ORGANIZATION.

The work of making operations safer and of showing employers and workmen how to organize to prevent accidents, many of which are due to carelessness and therefore avoidable, has been primarily one of the functions of the Board. It is recognized that preventable accidents are generally attributed to carelessness, insufficient inspection by employer, inexperience, unsafe practices, lack of safeguards, violation of instructions, indifference, defective equipment, poor judgment, and other indirect causes. The accident-prevention movement aims at minimizing such preventable accidents. It would appear that in some of the larger plants this accident-prevention campaign, assisted by efficient first-aid service, has resulted in reducing by 20 to 50 per cent. the number of accidents and attendant lay-offs that have occurred in past years. The financial records of these plants appear to bear out the foregoing conclusion.

Experience has proved that the satisfactory conducting of an accident-prevention campaign requires organization for carrying out three branches of work, as follows:—

(1.) An organization that provides an enthusiastic and hard-working safety committee or department, adequate inspection system, and hearty co-operation of officials and workmen:

(2.) A system of education that will assist all workmen to follow more careful, safe, and proper methods of work and will keep them constantly alert to the need of caution:

(3.) A scheme of safety measures designed to eliminate as far as possible dangerous conditions that have caused accidents or may cause them.

In this work the Board has had considerable assistance from workmen. These workmen have from time to time brought to the attention of the Board different plants and places of employment where more efficient safety-work might be done, and also from time to time have made valuable recommendations. It is realized that the workmen who daily come in contact with danger-zones are in a better position to give advice as to dangerous conditions than is an Inspector who possibly cannot visit the plant more than twice a year. Then, again, we feel that it is the duty of the workman to co-operate with the Board, so as to make safe his particular part of the plant or place of work not only for himself, but for his fellow-workman. From the above it can be seen that an essential element of accident-prevention work is the co-operation of the workmen themselves.

The various Inspectors under the "Factories Act," "Boilers Inspection Act," "Metalliferous Mines Inspection Act," the "Electrical Energies Act," and the "British Columbia Railway Act" have made over 1,400 inspections for the Board during the past year, the result of which has

been the installation of numerous mechanical safeguards and the improvement of working conditions from a safety standpoint. Their hearty, energetic, and careful work is much appreciated.

Employers throughout the past year, with one exception, have complied with the accident-prevention regulations and other suggestions for accident-prevention measures. This excellent co-operation has greatly facilitated the work and turned what would ordinarily be a disagreeable task into a work of pleasure, which in the end cannot help but bear fruit from a humanitarian as well as an economic standpoint. Only in one case above outlined was it necessary to close down a portion of the machinery of one plant until the proper safeguard had been installed. The opposition to the instalment of this safeguard was, we believe, more a case of ignorance than a deliberate desire to impede the work.

(*c.*) STATISTICAL.

In presenting the following data collected by the Statistical Department during the year 1918, it cannot be too firmly impressed upon the reader that the tables given do not intend to, and do not, represent the amounts paid as compensation in the different classes during 1918 by the Workmen's Compensation Board, neither do they deal with the total accidents occurring during the said year. The information given is obtained only from the accidents which were finally disposed of during 1918 irrespective of the year in which they occurred. It would be manifestly impossible to give reliable figures upon any other basis, since the extent of a workman's disability and the amount of the compensation to which he may be entitled cannot be estimated accurately, but must be decided by lapse of time. Many of the accidents dealt with, therefore, occurred during 1917, and conversely a large number of accidents which occurred during 1918 are not included, final payments on same not having been made. It is felt necessary that this explanation should be made since otherwise misconceptions might arise, and wrong deductions be made, were these facts not thoroughly understood.

In collecting information the Department has endeavoured to make an exhaustive analysis of the three primary classifications which are acknowledged to be vital to sound statistical work, i.e.:—

(1.) Industry:
(2.) Cause:
(3.) Nature of injury.

And whilst other interesting and doubtless useful information has been added, the main tables are based upon the aforementioned classifications.

Table A deals with the amounts paid out for temporary total and permanent partial disability and fatal accidents according to the particular industry in which they occurred. It will be noticed that the lumbering industry is responsible for a large percentage of accidents dealt with. Whilst it is true that lumbering is probably the principal industry of the Province, and that the industry would in consequence have a large number of accidents, it is also true that a number of these accidents could have been avoided by the exercising of a little more care upon the part of the employers and employees. It would not be possible to enter into minute details covering such accidents, but, to take a particular cause only, it might be mentioned that there have been several fatal accidents caused by the fastening of cables to dead trees, which trees, breaking when a strain was put upon the cable, fell upon the workman standing underneath same. Had a proper amount of care been taken in the selection of these trees, some of the accidents therefore could undoubtedly have been avoided. It might reasonably be argued, however, that in both the lumbering and ship-building industries (the latter being also responsible for a large percentage of the accidents) the number of accidents was adversely affected by a war-time demand for quick production, a shortage of skilled men, and a lack in many instances of the required material, necessitating the use of second-hand goods or makeshifts.

Table A 1 is a summary of all totals shown in Table A.

Table B deals with 8,841 temporary total disability accidents finalled during 1918. Taking the various accidents in the respective classes, the following particulars are shown:—

(1.) Workman's total wage loss:
(2.) Average compensation paid in the different classes:
(3.) Average daily wage:
(4.) Sex:
(5.) Conjugal state:
(6.) Average age:
(7.) Whether the workman was receiving other sick benefits:
(8.) Nationality.

Particularly noticeable features are the few women workers injured and the small percentage of workmen who were receiving other benefits, and who would consequently have been receiving no remuneration during the periods of disability were the "Workmen's Compensation Act" not in operation.

Table B 2 is a summary of totals shown in Table B.

Table C shows that causes of the various accidents dealt with and the amounts paid out for time lost, permanent partial disabilities, and fatals. It is of interest to note that included in "Accidents not elsewhere classified" is compensation paid for an aeroplane accident, the machine crashing in the City of Vancouver whilst the airman was testing out the aeroplane on behalf of the Provincial Government. Doubtless such claims will become common in the future, but to date this one is unique as far as this Board is concerned.

Table D shows the various parts of the workman's body which were injured in 8,841 temporary total disability accidents, the nature of the injury, and the classes of industry in which such injuries occurred.

Table E covers the permanent partial disability cases in which the workman lost one or more members of the body, suffered an impairment of same, underwent the loss or impairment of one of the five senses, or was facially disfigured. This is of special interest, since it is possible to group the injuries fairly representatively and to thus ascertain the average amount paid by the Board for a particular injury.

Chart 1 is drawn to show the respective proportions of 8,841 temporary total disability accidents according to the various classes of industry in which they occurred, the total being made up as follows:—

Ship-building	1,444
Logging	1,282
Sawmills	943
Coal-mining	932
Quarrying and mining	686
Railways	668
Navigation and stevedoring	341
Shingle-mills	288
Smelting	276
Manufacturing	258
Pulp and paper	246
Building and construction	243
Wood-working	225
Metal-working	201
Canning and packing	186
Machine-shops and foundries	182
Teaming	90
Municipalities	84
Explosives and chemicals	79
Wholesalers	41
Fishing	37
Miscellaneous	33
Provincial Government	26
Telegraph and telephone	22
Laundries	18
Janitors	10
Total	8,841

Chart 2 shows the proportions of 8,841 temporary total disability accidents with regard to the cause of such accidents, the figures being:—

Falling objects	1,954
Handling heavy objects	924
Hand-tools	899
Slipping and stumbling	738
Carried forward	4,515

Brought forward	4,515
Falls of persons	545
Power-working machinery	515
Conveying apparatus	469
Flying objects	383
Vehicles and transportation	456
Mine-cars	371
Striking projections	353
Sawmill machinery	227
Electricity and heat	215
Shingle-mill machinery	166
Poison	127
Transmission apparatus	112
Animals	102
Autos and motor-cycles	99
Explosions	73
Sharp instruments	28
Prime movers (steam and gas engines)	27
Shutting doors	21
Miscellaneous	14
Steam-pressure apparatus	13
Miscellaneous machinery	10
Total	8,841

Chart 3 is representative of the causes of 420 permanent partial disability (or the more serious) accidents, segregated as follows:—

Power-driven machinery	81
Shingle-mill	59
Falling objects	50
Sawmill machinery	45
Conveying apparatus	32
Flying objects	31
Handling heavy objects	25
Vehicles and transportation	19
Hand-tools	16
Transmission apparatus	12
Mine-cars	10
Slipping and stumbling	7
Falls of persons	7
Striking projections	6
Explosions	6
Prime movers (steam and gas engines)	4
Electricity and heat	3
Miscellaneous machinery	3
Animals	2
Shutting doors	2
Total	420

Interesting comparisons can be drawn by studying Charts 2 and 3 together, when it will be found that there is a wide discrepancy in the percentages of causes covering temporary total (or less serious) accidents and the permanent partial (or more serious) accidents. For example, "Slipping and stumbling" was responsible for 738 accidents, or 8.33 per cent. of the first named, whereas it only appears in Chart 3 as causing 1.66 per cent. of the permanent partial accidents. Again, whilst "Shingle-mill machinery" was the cause of 1.87 per cent. of the lighter accidents, the percentage in the more serious cases was 14.05 per cent., and so forth.

TABLE A.—STATEMENT SHOWING TOTAL AMOUNTS PAID IN EACH INDUSTRY ON ACCOUNT OF ALL FINALLED ACCIDENTS DURING 1918.

Sub-class.	Industry.	FINALLED TEMPORARY TOTAL DISABILITIES.		FINALLED PERMANENT PARTIAL DISABILITIES.						FATAL ACCIDENTS.					ALL FINAL AWARDS.
				CASH PAYMENTS.		MONTHLY PENSIONS.		TOTAL P.P.D. AWARDS.		PENSION AWARDS.		BURIAL AWARDS.		TOTAL FATAL AWARDS.	
		No. of Claims.	Amount of Compensation paid.	No. of Claims.	Amount.	No. of Claims.	Reserve.	No. of Claims.	Total P.P.D. Cost.	No.	Reserve.	No.	Amount.		Total Amount.
	Class No. 1.														
1	Creosoting-works	12	$ 712 80	1	$ 373 26	1	$ 1,774 80	..	$ 2,148 06	..	.....	..	.....	.....	$ 2,860 86
2	Lath-mills, including yards and delivery	3	17 01	..	.....	..	.....	..	.....	..	.....	1	$ 75 00	$ 75 00	92 01
3	Lumbering, including woods operation, logging, river-driving, rafting, or booming	1,282	90,175 09	45	12,631 36	12	13,116 89	..	25,748 25	11	$34,434 02	33	2,434 60	36,868 62	152,791 96
4	Pulp and paper manufacturing	246	11,012 29	12	1,865 58	2	2,441 84	..	4,307 42	3	9,678 77	2	126 55	9,805 32	25,125 03
5	Sawmills, including yards and delivery	943	39,899 41	53	16,746 43	19	13,939 21	..	30,685 64	9	34,735 65	9	652 90	35,388 55	105,973 60
6	Shingle-mills, including yards and delivery	288	16,724 01	67	13,637 54	5	3,102 89	..	16,740 43	2	3,820 47	3	225 00	4,054 47	37,518 91
7	Logging-railways (operation, maintenance, and construction)	103	8,653 91	4	2,246 83	2	1,278 38	..	3,525 21	2	8,482 28	6	415 05	8,897 33	21,076 45
		2,877	$167,194 52	182	$47,501 00	41	$35,654 01	..	$83,155 01	27	$91,160 19	54	$3,929 10	$95,089 29	$345,438 82
	Class No. 2.														
4	Broom and mop manufacturing	2	$ 87 86	1	$ 500 00	1	$ 243 91	..	$ 743 91	..	.....	..	.....	.....	$ 831 77
5	Carpentering (shop only)	1	5 78	..	.....	..	.....	..	.....	..	.....	..	.....	.....	5 78
6	Coffins, wooden, manufacturing	2	76 44	1	38 57	..	.....	..	38 57	..	.....	..	.....	.....	115 01
7	Cooperage (no stave or head manufacturing)	5	275 42	1	43 90	..	.....	..	43 90	..	.....	..	.....	.....	319 32
8	Veneer and excelsior manufacturing	17	307 90	3	211 75	..	.....	..	211 75	..	.....	..	.....	.....	519 65
9	Furniture-manufacturing	12	536 85	1	143 69	..	.....	..	143 69	..	.....	..	.....	.....	680 54
13	Wood-working plants, planing-mills	84	2,178 92	12	1,896 97	1	292 69	..	2,189 66	1	$ 4,447 23	..	.....	$ 4,447 23	8,815 81
14	Sash and door manufacturing	15	482 88	..	.....	..	.....	..	.....	..	.....	1	$ 75 00	75 00	557 88
16	Vehicle-manufacturing	3	257 18	..	.....	..	.....	..	.....	..	.....	..	.....	.....	257 18
17	Wooden-box manufacturing	46	991 45	8	988 50	2	797 49	..	1,785 99	..	.....	..	.....	.....	2,777 44
19	Lumber-yards operation (not connected with mills)	1	35 48	..	.....	..	.....	..	.....	..	.....	..	.....	.....	35 48
20	Spokes, staves, heads, manufacturing	7	220 40	..	.....	..	.....	..	.....	..	.....	..	.....	.....	220 40
21	Wooden-toy manufacturing	7	120 06	1	60 66	..	.....	..	60 66	..	.....	..	.....	.....	180 72
		202	$ 5,576 62	28	$ 3,884 04	4	$ 1,334 09	..	$ 5,218 13	1	$ 4,447 23	1	$ 75 00	$ 4,522 23	$ 15,316 98
	Class No. 3.														
1	Coal-mining	932	$ 50,483 92	21	$ 6,215 27	..	$ 6,814 98	..	$13,030 25	25	$93,332 17	41	$3,075 00	$96,407 17	$159,921 34
	Class No. 4.														
2	Cement-manufacturing (factory only)	2	$ 89 60	..	.....	..	.....	..	.....	..	.....	..	.....	.....	$ 89 60
4	Sand, shale, clay, and gravel pits	2	107 39	..	.....	..	.....	..	.....	..	.....	..	.....	.....	107 39
5	Sand, shale, clay, and gravel pits (hydraulic only)	1	1 93	..	.....	..	.....	..	.....	..	.....	..	.....	.....	1 93
6	Concentration of ore by water	2	58 99	..	.....	..	.....	..	.....	..	.....	..	.....	.....	58 99
7	Tiles, terra-cotta, sewer-pipe, earthenware, roof-tiles	1	69 30	..	.....	..	.....	..	.....	..	.....	..	.....	.....	69 30
10	Lime-kilns (no quarry)	4	76 06	..	.....	..	.....	..	.....	..	.....	..	.....	.....	76 06
11	Metal-mining	575	42,041 80	29	$ 8,207 03	11	$ 9,937 94	..	$18,144 97	10	$31,091 34	16	$1,180 00	$32,271 34	92,458 11
11A	Placer-mining, surface	11	222 92	..	.....	..	.....	..	.....	..	.....	..	.....	.....	222 92
13	Quarrying	7	250 01	1	87 10	..	.....	..	87 10	..	.....	..	.....	.....	337 11

15	Stone dressing or cutting	2	58 13	1	250 00	1	478 57	..	728 57	..		..			786 70
16	Reduction of ores and smelting	36	3,532 59	2	521 95	1	289 90	..	811 85	..		..			4,344 44
17	Brick-manufacturing, including clay-digging operations	5	76 32	..		..		..		..		..			76 32
17A	Brick-manufacturing (no clay-digging operations)	1	19 80	..		..		..		..		..			19 80
		649	$46,604 84	33	$9,066 08	13	$10,706 41	..	$19,772 49	10	$31,091 34	16	$1,180 00	$32,271 34	$98,648 67
	Class No. 5.														
1	Auto-repairing	42	$ 1,078 51	2	$ 308 43	..		..	$ 308 43	..		..			$ 1,386 94
3	Blacksmith-shops	17	676 31	1	278 67	..		..	278 67	..		..			954 98
4	Nuts, bolts, nails, spikes manufacturing (cold process)	1	8 93	..		..		..		..		..			8 93
5	Nuts, bolts, nails, spikes manufacturing (hot process)	1	4 80	..		..		..		..		..			4 80
6	Can-manufacturing (no hand-feed stamping)	35	647 67	2	39 87	..		..	39 87	..		..			687 54
7	Can-manufacturing (hand-feed stamping)	25	646 89	7	787 47	..		..	787 47	..		..			1,434 36
8A	Boiler-manufacturing	43	1,109 27	1	309 53	..		..	309 53	..		..			1,418 80
8B	Engine-manufacturing	2	181 91	..		..		..		..		..			181 91
9	Iron and steel foundry	66	1,884 05	1	144 62	..		..	144 62	..		..			2,028 67
9A	Brass-foundry	4	112 61	..		..		..		..		..			112 61
11	Machine-shops	73	2,418 17	5	664 66	1	$ 289 90	..	954 56	..		..			3,372 73
12	Iron, steel, metal products manufacturing (N.E.S.)	19	877 48	..		..		..		..		..			877 48
12A	Iron and steel manufacturing (N.E.S.)	2	78 11	..		..		..		..		..			78 11
12B	Babitt-metal manufacturing	1	5 41	..		..		..		..		..			5 41
13	Metalware (small) manufacturing	1	53 46	..		..		..		..		..			53 46
14	Ornamental-iron works (shop only)	2	6 52	..		..		..		..		..			6 52
15	Rolling-mills	4	185 18	1	71 28	..		..	71 28	..		..			256 46
16	Sheet-metal works (construction, erection, and repair)	9	162 71	..		..		..		..		..			162 71
17	Fabrication of structural steels, iron or metal	2	53 79	..		..		..		..		..			53 79
18	Acetylene welding	3	26 34	1	118 59	..		..	118 59	..		..			144 93
		352	$10,218 12	21	$2,723 12	1	$ 289 90	..	$ 3,013 02	..		..			$13,231 14
	Class No. 6.														
1	Tent and awning manufacturing	1	$ 20 85	..		..		..		..		..			$ 20 85
2A	Bakeries (with delivery)	8	489 43	..		..		..		..		..			489 43
2B	Bakeries (no delivery)	2	21 02	..		..		..		..		..			21 02
3	Confectionery-manufacturing	3	49 93	1	$ 220 41	..		..	$ 220 41	..		..			270 34
3A	Biscuit-manufacturing	4	24 05	..		..		..		..		..			24 05
4	Liquors and beverages manufacturing, including bottling and delivery	17	369 97	..		..		..		..		..			369 97
5	Butcher-shops	22	618 22	1	100 00	1	$ 651 83	..	751 83	..		..			1,370 05
7	Canning and packing fruits and vegetables	32	1,125 35	2	437 50	1	2,311 17	..	2,748 67	..		..			3,874 02
8	Teaming, cartage, warehousing, and storage	90	3,051 35	1	272 32	1	382 81	..	655 13	2	$ 7,518 10	2	$150 00	$ 7,668 10	11,374 58
9	Compounds (N.E.S.) manufacturing	8	547 54	1	280 54	..		..	280 54	..		..			828 08
11	Cleaning and dyeing	2	98 18	..		..		..		..		..			98 18
12	Cloth, textiles, or clothing manufacturing	11	81 02	..		..		..		..		..			81 02
12A	Fur-manufacturing	2	58 11	..		..		..		..		..			58 11
13A	Coal and wood yard (away from mill, with saw)	24	2,056 19	..		1	2,235 30	..	2,235 30	..		1	75 00	75 00	4,366 49
13B	Coal and wood operation (away from mill, no saw)	13	418 36	..		..		..		..		..			418 36
14	Cold-storage plants (no teaming)	2	169 68	..		..		..		..		..			169 68
15	Cold-storage plants (with teaming)	3	333 72	1	17 21	..		..	17 21	..		..			350 93
16	Creameries, including delivery	23	993 28	1	25 94	..		..	25 94	..		..			1,019 22
17	Drug-manufacturing	1	1 78	..		..		..		..		..			1 78
18	Elevators (operation)	6	457 06	..		..		..		..		..			457 06
21	Flour-milling	5	102 04	..		..		..		..		..			102 04
22	Food-products manufacturing (N.E.S.)	57	1,757 44	1	58 88	..		..	58 88	..		..			1,816 32
23	Handling of grain	8	323 83	..		..		..		..		..			323 83
	Carried forward	344	$13,168 40	9	$1,412 80	4	$5,581 11	..	$6,993 91	2	$7,518 10	3	$225 00	$ 7,743 10	$27,905 41

TABLE A.—STATEMENT SHOWING TOTAL AMOUNTS PAID IN EACH INDUSTRY ON ACCOUNT OF ALL FINALLED ACCIDENTS DURING 1918—*Continued.*

Sub-class.	Industry.	FINALLED TEMPORARY TOTAL DISABILITIES.		FINALLED PERMANENT PARTIAL DISABILITIES.						FATAL ACCIDENTS.					ALL FINAL AWARDS.
				CASH PAYMENTS.		MONTHLY PENSIONS.		TOTAL P.P.D. AWARDS.		PENSION AWARDS.		BURIAL AWARDS.		TOTAL FATAL AWARDS.	
		No. of Claims.	Amount of Compensation paid.	No. of Claims.	Amount.	No. of Claims.	Reserve.	No. of Claims.	Total P.P.D. Cost.	No.	Reserve.	No.	Amount.		Total Amount.
	Brought forward	344	$13,168 40	9	$ 1,412 80	4	$5,581 11	..	$ 6,993 91	2	$ 7,518 10	3	$225 00	$ 7,743 10	$ 27,905 41
	Class No. 6—Concluded.														
25	Glass manufacture and repair	1	8 25	..	.....	..	.....	..	.....	..	.....	..	.....	.....	8 25
26	Ice manufacturing and delivery	5	313 41	..	.....	..	.....	..	.....	1	1,686 71	..	.....	1,686 71	2,000 12
27	Janitors (at request)	10	312 48	..	.....	..	.....	..	.....	..	.....	..	.....	.....	312 48
28	Jewellery manufacturing	1	20 90	..	.....	..	.....	..	.....	..	.....	..	.....	.....	20 90
31	Laundries (power)	18	465 90	..	.....	..	.....	..	.....	..	.....	..	.....	.....	465 90
33	Leather-shoes manufacturing or repairing	2	54 60	..	.....	..	.....	..	.....	..	.....	..	.....	.....	54 60
34	Leather-goods manufacturing	1	4 55	..	.....	..	.....	..	.....	..	.....	..	.....	.....	4 55
36	Oil refining and distribution	18	387 23	..	.....	..	.....	..	.....	..	.....	..	.....	.....	387 23
37	Packing-houses (slaughtering, with or without teaming)	21	1,588 13	4	753 00	2	2,627 55	..	3,380 55	..	.....	..	.....	.....	4,968 68
38	Packing-houses (no slaughtering, with teaming)	15	165 48	..	.....	..	.....	..	.....	..	.....	..	.....	.....	165 48
38A	Packing-houses (no slaughtering, no teaming)	2	5 79	..	.....	..	.....	..	.....	..	.....	..	.....	.....	5 79
39	Paint-manufacturing	6	118 61	..	.....	..	.....	..	.....	1	3,972 59	1	$ 75 00	4,047 59	4,166 20
41	Printing, lithographing, engraving	22	877 65	6	743 90	3	2,942 09	..	3,685 99	..	.....	..	.....	.....	4,563 64
42	Rubber or rubber-goods manufacturing	5	122 85	1	115 00	..	.....	..	115 00	..	.....	..	.....	.....	237 85
43	Stationery-manufacturing	13	193 04	3	269 61	..	.....	..	269 61	..	.....	..	.....	.....	462 65
45	Wholesalers (with or without teaming)	41	1,125 54	1	52 83	..	.....	..	52 83	..	.....	..	.....	.....	1,178 37
		526	$18,932 81	24	$ 3,347 14	8	$11,150 75	..	$14,497 89	4	$13,177 40	4	$300 00	$13,477 40	$ 46,908 10
	Class No. 7.														
2	Bridge-building (steel)	2	$ 58 65	..	.....	..	.....	..	.....	..	.....	..	.....	.....	$ 58 65
3	Bridge-building (wooden)	11	756 41	..	.....	..	.....	..	.....	..	.....	..	.....	.....	756 41
4	Building construction (N.E.S.)	116	7,224 09	6	$ 943 90	3	$ 1,982 93	..	$ 2,926 83	1	$ 1,506 93	2	$150 00	$ 1,656 93	11,807 85
5	Structural carpentry	27	2,631 47	..	.....	..	.....	..	.....	..	.....	..	.....	.....	2,631 47
7	Reservoirs, dams, or flumes (construction without blast)	1	13 48	..	.....	..	.....	..	.....	..	.....	..	.....	.....	13 48
8	Dredging	9	857 48	1	277 81	..	.....	..	277 81	..	.....	..	.....	.....	1,135 29
9	Dry-docks, construction of	..	.....	..	.....	..	.....	..	.....	1	2,813 69	1	75 00	2,888 69	2,888 69
10	Electric wiring of buildings	5	297 95	..	.....	..	.....	..	.....	..	.....	..	.....	.....	297 95
14	Plumbing and heating	11	276 69	1	76 17	..	.....	..	76 17	1	3,760 03	1	75 00	3,835 03	4,187 89
15	House-moving	1	26 13	..	.....	..	.....	..	.....	..	.....	1	.....	.....	26 13
15A	House-wrecking	3	121 88	..	.....	..	.....	..	.....	..	.....	..	.....	.....	121 88
16	Installation of boilers, engines, machinery, marine elevators, iron stairs, or ornamental-iron works	2	32 14	..	.....	..	.....	..	.....	..	.....	..	.....	.....	32 14
18	Irrigation-works, construction of	1	57 70	..	.....	..	.....	..	.....	..	.....	..	.....	.....	57 70
19	Lathing	2	29 03	..	.....	..	.....	..	.....	..	.....	..	.....	.....	29 03
20A	Marine-railway operation, including repair of vessels not exceeding 50 tons weight	2	7 24	..	.....	..	.....	..	.....	..	.....	..	.....	.....	7 24
20B	Marine-railway operation	2	88 12	..	.....	..	.....	..	.....	..	.....	..	.....	.....	88 12
21	Mason-work	1	110 88	..	.....	..	.....	..	.....	..	.....	..	.....	.....	110 88
22	Painting	7	250 70	..	.....	..	.....	..	.....	..	.....	..	.....	.....	250 70

23	Painting (high steel or other structures)	1	389 50	1	417 06	..	.....	..	417 06	..	.....	..	.....	.....	806 56
25	Pier-construction	2	295 77	..	.....	..	.....	..	.....	..	.....	..	.....	.....	295 77
26	Pile-driving	20	1,107 00	..	.....	..	.....	..	.....	..	.....	..	.....	.....	1,107 00
27	Plastering	2	38 78	..	.....	..	.....	..	.....	..	.....	..	.....	.....	38 78
28	Reinforced-concrete erection	1	114 58	1	33 56	..	.....	..	33 56	..	.....	..	.....	.....	148 14
29	Road-making (with blasting)	1	821 15	1	644 47	1	1,064 43	..	1,708 90	..	.....	..	.....	.....	2,530 05
30	Road-making (without blasting)	2	95 17	..	.....	..	.....	..	.....	..	.....	..	.....	.....	95 17
31	Roofing	2	273 49	1	250 00	1	478 57	..	728 57	..	.....	..	.....	.....	1,002 06
32	Street cleaning or scavenging	3	143 07	..	.....	..	.....	..	.....	..	.....	..	.....	.....	143 07
34	Sewers (operation and maintenance, including new connections)	1	335 95	1	222 50	1	1,027 94	..	1,250 44	..	.....	..	.....	.....	1,586 39
35	Sewers (new construction or extension of plant)	5	246 62	..	.....	..	.....	..	.....	..	.....	..	.....	.....	246 62
36	Sheet-metal erection	3	245 25	..	.....	..	.....	..	.....	..	.....	..	.....	.....	245 25
37	Steel-frame erection	11	343 78	..	.....	..	.....	..	.....	..	.....	..	.....	.....	343 78
38	Steel-ship building (shop only)	148	5,151 28	6	1,386 63	3	1,419 37	..	2,806 00	..	.....	..	.....	.....	7,957 28
39	Steel-ship building (away from shop)	625	20,631 19	8	1,447 54	2	5,685 92	..	7,133 46	1	4,807 04	1	75 00	4,882 04	32,646 69
41	Tunnelling or well-digging	3	120 61	2	209 20	..	.....	..	209 20	..	.....	..	.....	.....	329 81
43	Waterworks (construction of stand-pipes or water-towers)	1	42 35	..	.....	..	.....	..	.....	..	.....	..	.....	.....	42 35
44	Waterworks operation and maintenance, including new connections	2	32 35	..	.....	..	.....	..	.....	..	.....	..	.....	.....	32 35
46	Window-cleaning	1	38 26	..	.....	..	.....	..	.....	..	.....	..	.....	.....	38 26
47	Wooden-ships construction (in shop)	72	3,435 64	7	2,182 47	4	2,079 69	..	4,262 16	1	1,704 59	..	.....	1,704 59	9,402 39
48	Wooden-ships construction (outside shop)	596	25,272 80	11	3,029 12	6	3,149 93	..	6,179 05	1	3,814 31	2	150 00	3,964 31	35,416 16
49	Boat-manufacturing (less than 50 tons weight)	3	80 79	..	.....	..	.....	..	.....	..	.....	..	.....	.....	80 79
		1,708	$72,095 42	47	$11,120 43	21	$16,888 78	..	$28,009 21	6	$18,406 59	7	$525 00	$18,931 59	$119,036 22
	Class No. 8.														
1	Auto transportation (passenger)	1	$ 4 23	..	.....	..	.....	..	.....	..	.....	..	.....	.....	$ 4 23
2	Electric light and power plants (lines and appliances, construction, and operation)	3	56 62	..	.....	..	.....	..	.....	..	.....	..	.....	.....	56 62
3	Electric railways (construction)	1	131 48	..	.....	..	.....	..	.....	..	.....	..	.....	.....	131 48
4	Electric railways (operation and maintenance)	48	2,709 85	3	$ 999 68	1	$ 289 90	..	$ 1,289 58	2	$ 8,186 83	1	$ 75 00	$ 8,261 83	12,261 26
6	Gasworks (construction or extension of plant)	5	163 03	..	.....	..	.....	..	.....	..	.....	..	.....	.....	163 03
6A	Gasworks (operation and maintenance, including new connections)	6	82 80	..	.....	..	.....	..	.....	..	.....	..	.....	.....	82 80
8	Motion-picture machine operation	1	86 16	..	.....	..	.....	..	.....	..	.....	..	.....	.....	86 16
10	Railway express and delivery	2	48 13	..	.....	..	.....	..	.....	..	.....	..	.....	.....	48 13
11	Steam-railways (operation and construction)	96	5,122 12	4	4,298 12	2	1,417 96	..	5,716 08	4	14,992 68	2	150 00	15,142 68	25,980 88
12A	Telegraph systems (operation)	3	63 53	..	.....	..	.....	..	.....	..	.....	..	.....	.....	63 53
12B	Telephone systems (line-work and construction)	2	35 19	..	.....	..	.....	..	.....	..	.....	..	.....	.....	35 19
13A	Telephone systems (operation only)	8	229 64	..	.....	..	.....	..	.....	..	.....	..	.....	.....	229 64
13B	Telephone systems (line-work and construction)	8	659 04	..	.....	..	.....	..	.....	..	.....	..	.....	.....	659 04
14	Theatre stage (operation)	1	153 77	..	.....	..	.....	..	.....	..	.....	..	.....	.....	153 77
		185	$ 9,545 59	7	$ 5,297 80	3	$ 1,707 86	..	$ 7,005 66	6	$23,179 51	3	$225 00	$23,404 51	$ 39,955 76
	Class No. 9.														
1	Navigation	53	$ 3,604 97	5	$ 977 20	1	$ 1,089 75	..	$ 2,066 95	5	$14,895 76	1	$ 75 00	$ 14,970 76	$ 20,642 68
2	Stevedoring	239	13,382 76	4	2,357 70	3	1,925 77	..	4,283 47	..	.....	..	.....	.....	17,666 23
3	Wharves (operation)	31	1,975 14	1	65 71	..	.....	..	65 71	..	.....	..	.....	.....	2,040 85
4	Salving	3	136 77	..	.....	..	.....	..	.....	..	.....	..	.....	.....	136 77
		326	$19,099 64	10	$ 3,400 61	4	$ 3,015 52	..	$ 6,416 13	5	$14,895 76	1	$ 75 00	$14,970 76	$ 40,486 53
	Class No. 10.														
1	Canadian Pacific Rly. Co. (construction and operation)	259	$12,598 71	11	$ 2,212 32	4	$ 2,334 41	..	$ 4,546 73	9	$27,881 46	8	$590 00	$28,471 46	$ 45,616 90
2	Canadian Pacific Ocean Services, Ltd	13	935 04	..	.....	..	.....	..	.....	..	.....	..	.....	.....	935 04
	Carried forward	272	$13,533 75	11	$2,212 32	4	$2,334 41	..	$4,546 73	9	$27,881 46	8	$590 00	$28,471 46	$46,551 94

TABLE A.—STATEMENT SHOWING TOTAL AMOUNTS PAID IN EACH INDUSTRY ON ACCOUNT OF ALL FINALLED ACCIDENTS DURING 1918—*Concluded.*

Sub-class.	Industry.	FINALLED TEMPORARY TOTAL DISABILITIES.		FINALLED PERMANENT PARTIAL DISABILITIES.						FATAL ACCIDENTS.					ALL FINAL AWARDS.
				CASH PAYMENTS.		MONTHLY PENSIONS.		TOTAL P.P.D. AWARDS.		PENSION AWARDS.		BURIAL AWARDS.		TOTAL FATAL AWARDS.	
		No. of Claims.	Amount of Compensation paid.	No. of Claims.	Amount.	No. of Claims.	Reserve.	No. of Claims.	Total P.P.D. Cost.	No.	Reserve.	No.	Amount.		Total Amount.
	Brought forward	272	$13,533 75	11	$2,212 32	4	$2,334 41	..	$4,546 73	9	$27,881 46	8	$590 00	$28,471 46	$46,551 94
	Class No. 10—Concluded.														
3A	Consolidated Mining & Smelting Co. of Canada, Ltd. (metal-mining)	91	5,482 80	12	4,972 02	2	1,981 15	..	6,953 17	1	4,002 33	2	150 00	4,152 33	16,588 30
3B	Consolidated Mining & Smelting Co. of Canada, Ltd. (smelting)	208	11,350 26	1	180 70	..	.....	..	180 70	..	.....	1	75 00	75 00	11,605 96
3C	Consolidated Mining & Smelting Co. of Canada, Ltd. (reduction works; no heat)	19	1,036 69	..	.....	..	.....	..	.....	..	.....	..	.....	.....	1,036 69
3D	Consolidated Mining & Smelting Co. of Canada, Ltd. (quarrying)	2	58 03	..	.....	..	.....	..	.....	..	.....	..	.....	.....	58 03
4	Dominion Express Co	8	130 31	..	.....	..	.....	..	.....	..	.....	..	.....	.....	130 31
5	Esquimalt & Nanaimo Rly. Co. (construction and operation)	17	561 98	..	.....	..	.....	..	.....	1	3,277 21	1	75 00	3,352 21	3,914 19
6	Kettle Valley Rly. Co. (construction and operation)	20	1,072 45	1	70 18	..	.....	..	70 18	..	.....	1	75 00	75 00	1,217 63
7	West Kootenay Power & Light Co	3	235 61	..	.....	..	.....	..	.....	..	.....	..	.....	.....	235 61
8	Coast Copper Co	1	1,060 40	1	1 99	1	2,366 49	..	2,368 48	..	.....	..	.....	.....	3,428 88
	Class No. 11.	641	$34,522 28	26	$7,437 21	7	$6,682 05	..	$14,119 26	11	$35,161 00	13	$965 00	$36,126 00	$84,767 54
2	Grand Trunk Pacific Coast S.S. Co	2	$ 160 61	..	.....	..	.....	..	.....	..	.....	..	.....	.....	$ 160 61
3	Grand Trunk Pacific Development Co., Ltd.	..	.....	1	$ 37 15	..	.....	..	$ 37 15	..	.....	..	.....	.....	37 15
4	Grand Trunk Pacific Rly. Co. (construction and operation)	32	1,518 67	..	.....	..	.....	..	.....	1	$ 3,506 56	..	.....	$ 3,506 56	5,025 23
5B	Grand Trunk Pacific Telegraph Co. (line-work and construction)	1	25 48	..	.....	..	.....	..	.....	..	.....	..	.....	.....	25 48
	Class No. 12.	35	$ 1,704 76	1	$ 37 15	..	.....	..	$ 37 15	1	$ 3,506 56	..	.....	$ 3,506 56	$ 5,248 47
1	Canadian Northern Pacific Rly. Co. (construction and operation)	82	$ 4,685 16	5	$ 969 72	2	$4,234 83	..	$ 5,204 55	1	$ 1,406 84	..	.....	$ 1,406 84	$11,296 55
	Class No. 13.														
1	Provincial Government employees	26	$ 1,879 34	..	.....	..	.....	..	.....	3	$15,860 99	1	$75 00	$15,935 99	$17,815 33
	Class No. 14.														
1	Municipalities (park-men)	4	$ 260 95	..	.....	..	.....	..	.....	..	.....	..	.....	.....	$ 260 95
2	Municipalities (fire department, paid)	21	885 21	..	.....	..	.....	..	.....	5	$19,468 65	5	$375 00	$19,843 65	20,728 86
3	Municipalities (police departments)	5	159 85	..	.....	..	.....	..	.....	..	.....	..	.....	.....	159 85
4	Municipalities (street cleaning and scavenging)	12	514 53	1	$ 454 71	..	.....	..	$ 454 71	..	.....	..	.....	.....	969 24
5A	Municipalities (water-works, operation, and maintenance, including new connections)	4	114 71	..	.....	..	.....	..	.....	..	.....	..	.....	.....	114 71
5B	Municipalities (waterworks, construction, or extension of plant)	2	52 80	..	.....	..	.....	..	.....	..	.....	..	.....	.....	52 80

7A	Municipalities (sewers, operation, and maintenance, including new connections)	3	222 27	..	.....	..	.....	..	.....	..	.....	..	.....	.....	222 27
7B	Municipalities (sewers, new construction, or extension of plant)	1	50 06	..	.....	..	.....	..	.....	..	.....	..	.....	.....	50 06
8A	Municipalities (road-making, without blasting)	18	720 35	..	.....	..	.....	..	.....	..	.....	..	.....	.....	720 35
8B	Municipalities (road-making, with blasting)	3	26 61	..	.....	..	.....	..	.....	..	.....	..	.....	.....	26 61
9	Municipalities (street-paving)	2	31 32	..	.....	..	.....	..	.....	..	.....	..	.....	.....	31 32
11A	Municipalities (electric railways, operation, and maintenance)	1	68 20	1	189 00	1	$ 736 95	..	925 95	..	.....	..	.....	.....	994 15
12	Municipalities (electric light and power plants, lines and appliances, construction and operation)	3	82 10	..	.....	..	.....	..	.....	1	4,479 70	1	75 00	4,554 70	4,636 80
14	Municipalities (ferries)	5	211 06	..	.....	..	.....	..	.....	1	3,467 15	1	75 00	3,542 15	3,753 21
		84	$ 3,400 02	2	$ 643 71	1	$ 736 95	..	$ 1,380 66	7	$27,415 50	7	$525 00	$27,940 50	$32,721 18
	Class No. 15.														
1	Canning and packing of fish	94	$ 4,995 38	2	$ 177 29	1	$ 848 28	..	$ 1,025 57	2	$ 8,556 66	2	$150 00	$ 8,706 66	$14,727 61
2	Fish oil and fertilizer manufacturing	3	726 54	..	.....	..	.....	..	.....	..	.....	..	.....	.....	726 54
37	Fishing or whaling	37	1,824 35	1	47 24	..	.....	..	47 24	..	.....	..	.....	.....	1,871 59
5	Kelp-collecting	3	277 53	..	.....	..	.....	..	.....	..	.....	..	.....	.....	277 53
		137	$ 7,823 80	3	$ 224 53	1	$ 848 28	..	$ 1,072 81	2	$ 8,556 66	2	$150 00	$ 8,706 66	$17,603 27
	Class No. 16.														
1	Explosives-manufacturing	67	$ 2,954 09	5	$1,469 03	1	$1,089 75	..	$ 2,558 78	2	$ 6,079 87	2	$150 00	$ 6,229 87	$11,742 74
4	Chemicals manufacturing (N.E.S.)	12	181 52	..	.....	..	.....	..	.....	..	.....	..	.....	.....	181 52
		79	$ 3,135 61	5	$1,469 03	1	$1,089 75	..	$ 2,558 78	2	$ 6,079 87	2	$150 00	$ 6,229 87	$11,924 26

TABLE A 1.—SUMMARY BY CLASSES OF TABLE A.

Class.	FINALLED TEMPORARY TOTAL DISABILITIES.		FINALLED PERMANENT PARTIAL DISABILITIES.						FATAL ACCIDENTS.					ALL FINAL AWARDS.
			CASH PAYMENTS.		MONTHLY PENSIONS.		TOTAL P.P.D. AWARDS.		PENSION AWARDS.		BURIAL AWARDS.		TOTAL FATAL AWARDS.	
	No. of Claims.	Amount of Compensation paid.	No. of Claims.	Amount.	No. of Claims.	Reserve.	No. of Claims.	Total P.P.D. Cost.	No.	Reserve.	No.	Amount.		Total Amount.
Class No. 1	2,877	$ 167,194 52	182	$ 47,501 00	41	$ 35,654 01	..	$ 83,155 01	27	$ 91,160 19	54	$ 3,929 10	$ 95,089 29	$ 345,438 82
Class No. 2	202	5,576 62	28	3,884 04	4	1,334 09	..	5,218 13	1	4,447 23	1	75 00	4,522 23	15,316 98
Class No. 3	932	50,483 92	21	6,215 27	..	6,814 98	..	13,030 25	25	93,332 17	41	3,075 00	96,407 17	159,921 34
Class No. 4	649	46,604 84	33	9,066 08	13	10,706 41	..	19,772 49	10	31,091 34	16	1,180 00	32,271 34	98,648 67
Class No. 5	352	10,218 12	21	2,723 12	1	289 90	..	3,013 02	..	.....	..	.....	.....	13,231 14
Class No. 6	526	18,932 81	24	3,347 14	8	11,150 75	..	14,497 89	4	13,177 40	4	300 00	13,477 40	46,908 10
Class No. 7	1,708	72,095 42	47	11,120 43	21	16,888 78	..	28,009 21	6	18,406 59	7	525 00	18,931 59	119,036 22
Class No. 8	185	9,545 59	7	5,297 80	3	1,707 86	..	7,005 66	6	23,179 51	3	225 00	23,404 51	39,955 76
Class No. 9	326	19,099 64	10	3,400 61	4	3,015 52	..	6,416 13	5	14,895 76	1	75 00	14,970 76	40,486 53
Class No. 10	641	34,522 28	26	7,437 21	7	6,682 05	..	14,119 26	11	35,161 00	13	965 00	36,126 00	84,767 54
Class No. 11	35	1,704 76	1	37 15	..	.....	..	37 15	1	3,506 56	..	.....	3,506 56	5,248 47
Class No. 12	82	4,685 16	5	969 72	2	4,234 83	..	5,204 55	1	1,406 84	..	.....	1,406 84	11,296 55
Class No. 13	26	1,879 34	..	.....	..	.....	..	.....	3	15,860 99	1	75 00	15,935 99	17,815 33
Class No. 14	84	3,400 02	2	643 71	1	736 95	..	1,380 66	7	27,415 50	7	525 00	27,940 50	32,721 18
Class No. 15	137	7,823 80	3	224 53	1	848 28	..	1,072 81	2	8,556 66	2	150 00	8,706 66	17,603 27
Class No. 16	79	3,135 61	5	1,469 03	1	1,089 75	..	2,558 78	2	6,079 87	2	150 00	6,229 87	11,924 26
Totals	8,841	$456,902 45	415	$103,149 73	107	$101,154 16	..	$204,491 00	111	$387,677 61	152	$11,249 10	$398,926 71	$1,060,320 16

TABLE B.—ANALYSIS OF 8,841 TEMPORARY TOTAL DISABILITY ACCIDENTS.

Sub-class.	Industry.	No. of Accidents.	Total Wage Loss.	Average Time Lost paid.	Average Duration of Disability in Days.	Average Daily Wage.	Sex. Male.	Sex. Female.	Conjugal State. Married.	Conjugal State. Single.	Conjugal State. Unknown.	Average Age.	Received other Benefits.	Nationality. British.	Canadian.	American.	French.	Italian.	Russian.	German.	Austrian.	Chinese.	Japanese.	Scandinavian.	Natives of India.	Others.
	Class No. 1.																									
1	Creosoting-works	12	$ 1,429 45	$59 40	37.91	$3 72	11	1	7	3	2	35	...	7	1	....	....	....	....	....	....	1	....	....	3	..
2	Lath-mills, including yards and delivery	3	50 27	5 67	10.33	2 12	3	..	2	1	....	34	....	1	....	....	....	....	....	....	....	2	....	....	....	..
3	Lumbering, including cutting, logging, rafting, or booming	1282	185,641 66	70 34	34.80	4 94	1279	3	419	821	42	37	19	414	242	166	9	20	95	9	26	28	72	151	11	39
4	Pulp and paper manufacturing	246	23,099 93	44 76	24.74	4 17	245	1	142	84	20	34	10	59	33	26	2	22	18	3	6	7	37	6	10	17
5	Sawmills, including yards and delivery	943	83,757 90	42 31	29.41	3 68	940	3	528	347	68	37	17	253	89	44	1	12	15	5	8	182	224	18	74	18
6	Shingle-mills, including yards and delivery	288	34,742 97	58 06	33.21	4 24	287	1	192	83	13	34	3	37	23	17	....	....	....	....	1	..	174	29	5	....	2
7	Logging-railways (operation, maintenance, and construction)	103	17,923 47	84 01	45.79	4 83	103	..	40	60	3	35	2	29	14	20	2	5	14	..	2	5	1	6	1	4
		2877	$346,645 65	.....	.....	.....	2868	9	1330	1399	148	35	51	860	402	273	14	59	142	18	42	399	363	186	99	80
	Class No. 2.																									
4	Broom and mop manufacturing	2	$ 178 27	$43 93	56.50	$3 18	2	..	1	1	....	26	....	....	....	1	....	....	....	..	..	....	....	....	....	1
5	Carpentering (shop only)	1	19 50	5 78	7.50	3 00	1	..	1	....	....	57	....	1	....	....	....	....	....	..	..	....	....	....	....	..
6	Coffins, wooden, manufacturing	2	163 94	38 22	25.00	4 15	2	..	2	....	....	35	....	1	....	....	....	....	....	..	..	1	....	....	....	..
7	Cooperage (no stave or head manufacturing)	5	560 00	55 08	42.30	3 95	5	..	3	1	1	45	....	1	2	....	....	....	....	..	..	2	....	....	....	..
8	Veneer and excelsior manufacturing	17	666 01	18 11	17.85	2 89	13	4	8	7	2	41	....	14	....	....	1	....	....	..	..	1	1	....	....	..
9	Furniture-manufacturing	12	1,117 30	44 73	34.71	3 18	12	..	8	4	....	40	1	11	....	....	....	....	....	..	..	1	....	....	....	..
13	Wood-working plants, including planing-mills	84	4,830 38	25 93	21.42	3 43	84	..	49	30	5	38	2	34	7	7	....	1	....	..	1	12	17	2	2	1
14	Sash and door manufacturing	15	1,058 23	32 19	23.30	4 01	15	..	8	7	...	42	....	12	2	1	....	....	....	..	..	....	....	....	....	..
16	Manufacturing vehicles	3	504 51	85 72	54.50	4 16	3	..	2	1	....	44	1	2	1	....	....	....	....	..	..	....	....	....	....	..
17	Manufacturing wooden boxes	46	2,309 06	21 55	22 18	2 80	46	..	17	27	2	27	....	25	6	....	....	....	....	..	1	7	3	1	1	2
19	Operating lumber-yards (not connected with mills)	1	73 50	35 48	29.50	3 00	1	..	1	....	....	53	....	1	....	....	....	....	....	..	..	....	....	....	....	..
20	Manufacturing spokes, staves, and heads	7	455 59	31 48	27.43	2 76	7	..	3	1	3	35	....	2	....	1	....	....	....	..	..	4	....	....	....	..
21	Manufacturing wooden toys	7	238 74	17 15	24.43	1 97	1	6	1	5	1	24	....	2	4	....	....	....	....	..	..	....	....	....	....	1
		202	$12,175 03	.....	.....	.....	192	10	104	84	14	39	4	106	22	10	1	1	....	..	2	28	21	3	3	5
	Class No. 3.																									
1	Coal-mining	932	$105,539 42	$54 16	32.37	$4 41	932	..	571	350	11	34	346	450	50	15	2	112	60	7	76	78	36	6	....	40
	Class No. 4.																									
2	Cement-manufacturing (factory only)	2	$ 177 75	$44 80	51.25	$2 47	2	..	1	1	....	23	....	1	....	....	....	....	....	..	..	1	....	....	....	..
4	Sand, clay, shale, and gravel pits	2	220 40	53 69	34.50	4 17	2	..	2	....	...	42	....	2	....	....	....	....	....	..	..	....	....	....	....	..
5	Sand, clay, shale (hydraulic only)	1	14 00	1 93	5.00	3 50	1	..	1	.	....	37	....	1	....	....	....	....	....	..	..	....	....	....	....	..
6	Concentration of ore by water	2	142 50	29 49	14.00	5 87	2	..	....	2	....	29	....	1	....	....	....	....	....	..	..	....	....	1	....	..
7	Tiles, terra-cotta, sewer-pipe, roof-tiles manufacturing	1	135 00	69 30	55.00	3 00	1	..	1	.	....	50	....	....	....	....	....	....	....	..	..	1	....	....	....	..
10	Lime-kilns (no quarry)	4	181 50	19 01	14.50	3 60	4	..	3	1	....	31	....	3	....	....	....	....	....	..	..	1	....	....	....	..
11	Metal-mining	575	84,895 90	73 11	32.78	4 69	574	1	225	340	10	38	18	207	74	36	1	74	47	3	24	1	6	52	....	50
11A	Placer-mining (surface)	11	593 07	20 26	10.54	4 97	11	..	5	6	....	44	....	2	2	3	....	....	....	..	..	2	....	2	....	..
13	Quarrying	7	610 36	35 71	27.71	4 65	7	..	5	2	....	35	....	3	....	....	....	1	1	..	..	1	....	1	....	..
15	Stone dressing or cutting	2	139 37	29 06	8.50	5 62	2	..	2	....	....	39	....	2	....	....	....	....	....	..	..	....	....	....	....	..

16	Reduction of ores and smelting	36	$ 6,412 96	$98 12	34.86	$4 52	36	..	17	19	....	32	1	11	6	2	....	4	4	..	2	1	2	....	....	4
17	Brick-manufacturing, including clay-digging operations	5	154 00	15 26	13.10	4 05	5	..	5	....	....	48	....	2	....	....	....	1	....	..	..	1	....	....	....	1
17A	Brick-manufacturing (no clay-digging operations)	1	49 50	19 80	14.00	4 50	1	..	1	....	....	38	....	1	....	....	....	....	....	..	..	....	....	....	....	..
		649	$93,726 31	.....	.....	.....	648	1	268	371	10	....	19	236	82	41	1	80	52	3	26	9	8	56	....	55
	Class No. 5.																									
1	Auto-repairing	42	$ 2,330 62	$25 67	22.37	$3 45	42	..	17	22	3	26	....	29	8	2	....	....	....	..	....	....	....	....	....	3
3	Blacksmith-shops	17	1,457 58	39 78	23.91	4 78	17	..	10	7	....	36	....	13	1	....	....	....	....	1	..	....	....	....	....	2
4	Nuts, bolts, nails, spikes, manufacturing (cold process)	1	26 00	8 93	10.00	3 25	1	..	....	1	....	18	....	1	....	....	....	....	....	..	....	....	....	....	..
5	Nuts, bolts, nails, spikes, manufacturing (hot process)	1	17 46	4 80	10.00	2 91	1	..	....	1	....	17	....	1	....	....	....	....	....	..	....	....	....	....	..
6	Manufacturing cans (no hand-feed stamping)	35	1,436 16	18 50	22.97	2 52	20	15	6	28	1	23	....	14	12	3	....	2	....	..	1	....	....	....	....	3
7	Manufacturing cans (hand-feed stamping)	25	1,370 77	25 87	23.10	2 57	17	8	8	17	....	23	....	17	5	2	....	....	....	..	....	....	....	....	....	1
8A	Manufacturing boilers	43	2,847 61	25 79	14.96	4 88	43	..	22	21	....	33	1	35	3	3	....	....	....	..	....	....	1	....	....	1
8B	Manufacturing engines	2	355 53	90 95	42.00	4 18	2	..	2	....	....	50	....	....	....	2	....	....	....	..	....	....	....	....	....	1
9	Iron and steel foundry	66	4,314 19	28 54	17.91	4 42	66	..	43	22	1	37	1	47	6	3	....	3	2	..	....	1	2	....	....	2
9A	Brass-foundry	4	249 96	28 15	18.87	3 77	4	..	3	1	....	27	....	1	3	....	....	....	....	..	....	....	....	....	....	..
11	Machine-shops	73	5,408 59	33 12	23.31	4 09	73	..	39	33	1	34	2	49	10	6	....	1	2	..	....	2	1	....	....	2
12	Manufacturing iron, steel, and metal products (N.E.S.)	19	1,841 30	46 18	30.89	3 97	19	..	10	9	....	35	....	6	2	2	....	3	....	..	3	....	3	....	....	..
12A	Iron and steel manufacturing (N.E.S.)	2	175 98	39 05	18.00	5 65	2	..	2	....	....	49	....	....	....	1	....	....	....	..	....	....	....	....	....	1
12B	Manufacturing babbitt-metal	1	29 52	5 41	4.50	6 56	1	..	1	....	....	45	....	1	....	....	....	....	....	..	....	....	....	....	....	..
13	Manufacturing small metalware	1	108 00	53 46	38.00	3 60	1	..	1	....	....	38	....	....	....	....	....	....	....	..	1	....	....	....	....	..
14	Ornamental-ironworks	2	32 19	3 26	7.00	3 39	2	..	2	....	....	32	....	2	....	....	....	....	....	..	....	....	....	....	....	..
15	Rolling-mills	4	375 72	46 29	29.00	3 26	4	..	3	1	....	35	....	2	....	....	....	1	1	..	....	....	....	....	....	..
16	Sheet-metal works	9	400 45	18 07	16.85	3 73	9	..	1	8	....	24	....	6	3	....	....	....	....	..	....	....	....	....	....	..
17	Fabrication of structural steel	2	125 60	26 89	19.50	5 30	2	..	2	....	....	45	....	2	....	....	....	....	....	..	....	....	....	....	....	..
18	Acetylene welding	3	66 46	8 78	7.66	3 92	3	..	....	3	....	26	....	1	2	....	....	....	....	..	....	....	....	....	....	..
		352	$22,969 69	.....	.....	.....	329	23	172	174	6	....	4	227	55	24	....	10	5	1	5	....	6	4	....	15
	Class No. 6.																									
1	Tents and awnings, manufacturing	1	$ 71 75	$20 85	31.00	$3 50	1	..	1	....	....	38	....	....	....	....	....	....	....	..	..	....	....	1	....	..
2A	Bakeries (with delivery)	8	869 98	61 17	41.91	3 20	8	..	3	5	....	30	....	5	2	....	....	1	....	..	..	....	....	....	....	..
2B	Bakeries (without delivery)	2	55 90	10 51	13.75	2 98	2	..	1	1	....	31	....	1	....	....	....	....	....	..	..	....	1	....	....	..
3	Manufacturing confectionery	4	127 22	12 48	14.12	3 05	4	..	1	3	....	27	1	2	....	1	....	....	....	..	..	....	1	....	....	..
3A	Manufacturing biscuits	4	39 31	6 01	12.87	1 03	1	3	....	4	....	17	....	3	1	....	....	....	....	..	..	....	....	....	....	..
4	Manufacturing liquors and beverages	17	824 36	21 76	17.88	3 07	15	2	5	12	....	30	1	14	1	1	....	1	....	..	..	....	....	....	....	..
5	Butcher-shops	22	1,288 94	28 10	23.86	3 17	21	1	10	12	....	33	....	15	4	2	....	....	....	1	..	....	....	....	....	..
7	Canning and packing fruits and vegetables	32	2,345 43	35 16	23.98	3 12	25	7	18	14	...	34	....	23	7	....	....	....	....	..	2	....	....	....	....	..
8	Teaming, carting, warehousing, and storage	90	6,827 95	33 90	26.79	3 46	90	..	51	37	2	38	4	53	23	7	....	....	1	..	4	....	1	....	1
9	Manufacturing compounds (N.E.S.)	8	1,078 21	68 44	55.19	2 57	7	1	3	4	1	38	....	5	1	....	....	....	....	..	1	1	....	....	....	..
11	Cleaning and dyeing	2	195 00	49 09	41.50	2 75	1	1	1	1	....	41	....	1	1	....	....	....	....	..	....	....	....	....	....	..
12	Cloth, textile, or clothing manufacturing	11	264 00	7 36	15.09	3 66	10	1	2	8	1	27	....	6	1	1	....	....	2	..	....	1	....	....	....	..
12A	Fur-manufacturing	2	123 55	29 05	25.25	3 01	2	..	....	2	....	26	....	2	....	....	....	....	....	..	....	....	....	....	....	..
13A	Coal and wood yard (away from mill, with machinery)	24	3,323 53	85 67	61.65	3 33	24	..	19	4	1	46	1	9	5	3	....	....	....	..	2	3	....	1	1	..
13B	Coal and wood yard (away from mill, without machinery)	13	857 43	32 18	22.27	3 57	13	..	9	3	1	31	....	9	1	1	....	1	....	..	....	1	....	....	....	..
14	Cold-storage plants (no teaming)	2	232 92	84 84	45.00	4 08	2	..	2	....	....	36	1	2	....	....	....	....	....	..	....	....	....	....	....	..
15	Cold-storage plants (with teaming)	3	642 03	111 24	67.00	3 91	3	..	3	....	....	39	1	3	....	....	....	....	....	..	....	....	....	....	....	..
16	Creameries	23	2,013 20	43 18	26.87	3 17	21	2	14	9	....	30	....	17	2	2	....	....	....	..	....	....	....	....	....	..
17	Manufacturing drugs	1	12 92	1 78	4.00	3 23	1	..	1	....	....	50	....	1	....	....	....	....	....	..	....	....	....	....	....	..
18	Operating elevators	6	897 23	76 17	59.50	2 88	6	..	4	2	....	31	1	5	....	....	....	....	....	..	....	....	....	....	....	1
21	Flour-milling	5	204 60	20 41	14.30	3 81	5	..	4	1	....	37	1	2	2	....	....	....	....	..	1	....	....	....	....	..
22	Manufacturing food products (N.E.S.)	57	3,800 97	30 83	22.33	3 53	46	11	32	24	1	34	3	43	4	4	....	....	....	..	3	....	....	....	....	3
23	Handling of grain	8	671 63	40 48	32.94	3 49	8	..	4	4	....	36	....	7	1	....	....	....	....	..	....	....	....	....	....	..
25	Manufacturing and repairing glass	1	20 90	8 25	21.00	2 00	1	..	....	1	....	15	....	1	....	....	....	....	....	..	....	....	....	....	....	..
26	Manufacturing ice	5	627 21	62 68	38.40	3 88	5	..	4	1	....	44	....	3	2	....	....	....	....	..	....	....	....	....	....	..
27	Janitors (at request)	10	657 21	31 25	25.00	3 24	10	..	9	1	....	41	2	7	....	1	....	1	....	..	....	1	....	....	....	..
28	Manufacturing jewellery	1	50 00	20 90	15.50	4 00	1	..	1	....	....	33	....	1	....	....	....	....	....	..	....	....	....	....	....	..
31	Laundries	18	1,039 71	25 88	27.11	2 21	7	11	6	12	....	28	1	12	2	1	....	....	....	..	1	....	....	....	....	2
33	Manufacturing or repairing leather shoes	2	114 29	27 30	24.25	2 56	2	..	....	2	....	25	2	1	....	1	....	....	....	..	....	....	....	....	....	..
	Carried forward	382	$29,277 38	$1,086 92	850.22	92 46	342	40	208	167	7	..	19	253	60	25	....	3	4	1	4	12	7	2	1	10

TABLE B.—ANALYSIS OF 8,841 TEMPORARY TOTAL DISABILITY ACCIDENTS—*Continued.*

Sub-class.	Industry.	No. of Accidents.	Total Wage Loss.	Average Time Lost paid.	Average Duration of Disability in Days.	Average Daily Wage.	Sex.		Conjugal State.			Average Age.	Received other Benefits.	Nationality.											
							Male.	Female.	Married.	Single.	Unknown.			British.	Canadian.	American.	French.	Italian.	Russian.	German.	Austrian.	Chinese.	Japanese.	Scandinavian.	Natives of India.	Others.
	Brought forward	382	$29,277 38	$1,086 92	850.22	92 46	342	40	208	167	7	....	19	253	60	25	....	3	4	1	4	12	7	2	1	10
	Class No. 6—Concluded.																								
34	Manufacturing leather goods	1	7 20	4 55	12.00	0 90	....	1	....	1	....	20	..	1	....	....	....	....	....	..	....	....	....	....	..
36	Oil refining and distribution	18	1,320 78	32 62	19.72	4 44	18	..	10	8	....	39	1	11	4	....	....	....	....	1	..	....	....	....	2
37	Packing-houses (slaughtering with or without teaming)	21	3,130 89	75 62	51.02	3 83	21	..	12	8	1	35	1	13	2	1	....	4	....	..	..	....	....	....	....	1
38	Packing-houses (no slaughtering, with teaming)	15	465 65	11 03	10.57	3 66	13	2	10	4	1	31	3	5	3	1	....	1	....	..	..	1	....	2	....	2
38A	Packing-houses (no slaughtering, no teaming)	2	34 14	2 89	6.50	4 02	2	..	1	1	....	31	....	1	1	....	....	....	....	..	..	....	....	....	....	..
39	Manufacturing paints	6	248 22	19 77	22.25	2 79	6	..	3	3	....	32	....	3	2	1	....	....	....	..	..	....	....	....	....	..
41	Printing, lithographing, and engraving	22	1,730 87	39 89	35.77	3 36	21	1	9	12	1	27	3	15	2	2	....	....	....	..	..	....	....	....	....	3
42	Manufacturing rubber or rubber goods	5	271 67	24 57	23.00	3 25	5	..	2	3	....	27	....	2	2	1	....	....	....	..	..	....	....	....	....	..
43	Manufacturing stationery	13	398 14	14 84	19.42	1 93	5	8	4	9	....	22	1	12	....	1	....	....	....	..	..	....	....	....	....	..
45	Wholesalers (with or without teaming)	41	2,623 72	27 45	33.42	3 25	41	..	25	15	1	31	1	28	10	....	....	1	1	..	..	....	....	....	....	1
		526	$39,508 66	.....	.....	.....	474	52	284	231	11	....	29	344	86	32	....	9	5	2	4	13	7	4	1	19
	Class No. 7.																								
2	Bridge-building (steel)	2	$ 97 80	$ 29 32	16.50	$4 65	2	..	2	....	....	27	1	2	....	....	....	....	....	..	..	....	....	....	....	..
3	Bridge-building (wooden)	11	1,707 95	68 76	28.32	5 66	11	..	5	6	....	43	1	6	5	....	....	....	....	..	..	....	....	....	....	..
4	Building construction (N.E.S.)	116	14,352 30	62 27	35.04	4 58	116	..	72	39	5	42	7	69	15	11	....	4	4	..	1	....	3	6	1	2
5	Structural carpentry	27	4,988 87	97 46	38.74	5 33	27	..	9	16	2	42	1	10	10	2	....	1	....	..	..	....	1	1	....	2
7	Reservoirs, dams, or flumes (construction, no blasting)	1	35 00	13 48	13.00	3 50	1	..	1	....	....	68	....	1	....	....	....	....	....	..	..	....	....	....	....	..
8	Dredging	9	31 95	95 27	43.05	3 55	9	..	6	3	....	41	....	7	1	....	....	....	....	..	..	....	....	1	....	..
9	Construction of dry-docks	....	.....	.....	.....	.....	....	..	....	....	....	....	....	....	....	....	....	....	....	..	..	....	....	....	....	..
10	Electric wiring of buildings	5	622 96	59 59	29.30	5 41	5	..	4	1	....	34	....	4	....	....	....	....	....	..	..	....	1	....	....	..
14	Plumbing and heating	11	650 99	25 15	15.82	4 51	11	..	8	3	....	36	....	9	1	....	....	....	....	..	..	....	....	....	....	1
15	House-moving	1	62 50	26 13	15.50	5 00	1	..	....	1	....	36	....	1	....	....	....	....	....	..	..	....	....	....	....	..
15A	House-wrecking	3	264 80	40 62	22 00	4 80	3	..	3	....	....	47	....	....	2	....	....	....	....	..	..	....	....	....	....	1
16	Installation of boilers, engines, machinery, etc	2	90 63	16 07	10.75	5 37	2	..	2	....	....	34	....	....	1	1	....	....	....	..	..	....	....	....	....	..
18	Construction of irrigation-works	1	114 00	57 70	22.00	6 00	1	..	1	....	....	56	....	1	....	....	....	....	....	..	..	....	....	....	....	..
19	Lathing	2	76 35	14 51	13.25	3 93	2	..	2	....	....	34	....	1	1	....	....	....	....	..	..	....	....	....	....	..
20A	Marine-railway operating (boats under 50 tons)	2	46 68	3 62	5.75	5 58	2	..	2	....	....	43	....	2	....	....	....	....	....	..	..	....	....	....	....	..
20B	Marine-railway operating (boats over 50 tons)	2	181 37	44 06	31.25	3 52	2	..	1	1	....	50	....	1	1	....	....	....	....	..	..	....	....	....	....	..
21	Mason-work	1	211 20	110 88	80.00	3 20	1	..	1	....	....	63	....	1	....	....	....	....	....	..	..	....	....	....	....	..
22	Painting	7	547 73	35 81	23.07	4 36	7	..	6	1	....	37	....	4	....	....	....	1	....	..	..	....	....	1	....	1
23	Painting (high structures)	1	717 36	389 50	225.00	3 92	1	..	1	....	....	34	....	1	....	....	....	....	....	..	..	....	....	....	....	..
25	Pier-construction	2	560 25	147 88	63.75	3 75	2	..	1	1	....	43	....	1	1	....	....	....	....	..	..	....	....	....	....	..
26	Pile-driving	20	2,436 57	55 35	26.75	5 57	20	..	4	15	1	43	....	9	7	2	....	....	....	..	..	....	....	1	....	1
27	Plastering	2	112 50	19 39	9.75	6 25	2	..	2	....	....	48	....	1	....	1	....	....	....	..	..	....	....	....	....	..
28	Reinforced concrete erection	1	219 95	114 58	65.00	4 15	1	..	1	....	....	34	....	1	....	....	....	....	....	..	..	....	....	....	....	..
29	Road-making (with blasting)	1	1,514 00	321 15	335.00	4 00	1	..	....	1	....	57	....	1	....	....	....	....	....	..	..	....	....	....	....	..
30	Road-making (without blasting)	2	234 00	47 58	28.25	5 75	2	..	1	1	....	36	....	....	1	....	....	1	....	..	..	....	....	....	....	..
31	Roofing	2	525 75	136 74	67.50	4 75	2	..	2	....	....	31	....	....	....	2	....	....	....	..	..	....	....	....	....	..
32	Street cleaning or scavenging	3	287 70	47 69	41.50	3 06	3	..	3	....	....	38	....	2	1	....	....	....	....	..	..	....	....	....	....	..
34	Sewers (operating and maintenance)	1	617 40	335 95	289.00	2 80	1	..	1	....	....	64	....	1	....	....	....	....	....	..	..	....	....	....	....	..
35	Sewers (new construction or extension of plant)	5	311 64	49 32	19.40	4 18	5	..	3	2	....	35	....	1	....	....	....	4	....	..	..	....	....	....	....	..

36	Sheet-metal erection	3	$ 522 60	$81 75	55.33	$3 90	3	..	2	1	....	24	..	3	....	....	....	....	....	..	..	....	....	....	....	..
37	Steel-frame erection	11	783 05	31 25	18.82	4 28	11	..	3	7	1	33	....	7	2	....	....	....	1	..	..	....	....	1	....	..
38-9	Steel-ship building	773	57,690 19	33 35	21.58	4 50	773	..	466	291	17	35	24	540	109	53	2	28	8	..	..	....	....	14	....	19
41	Tunnelling or well-digging	3	271 00	40 20	21.67	5 50	3	..	1	2	....	43	....	2	....	....	....	....	....	..	1	....	....	....	....	..
43	Waterworks (construction of stand-pipes or towers)	1	87 50	42 35	29.00	3 50	1	..	1	....	....	40	....	....	....	1	....	....	....	..	..	....	....	....	....	..
44	Waterworks (operation and maintenance)	2	48 72	16 17	21.00	1 76	2	..	2	....	....	42	....	2	....	....	....	....	....	..	..	....	....	....	....	..
46	Window-cleaning	1	99 64	38 26	38.50	3 44	1	..	1	....	....	29	....	1	....	....	....	....	....	..	..	....	....	....	....	..
47-8	Wooden-ship building	668	61,486 36	42 97	22.18	4 85	668	..	466	191	11	36	24	459	123	32	4	14	10	1	..	....	....	6	....	19
49	Building boats (less than 50 tons weight)	3	186 00	26 93	18.16	4 17	3	..	2	1	....	44	....	....	2	....	....	....	....	..	..	....	1	....	....	..
		1708	$152,795 26	.....	.....	.....	1708	..	1087	584	37	....	58	1151	283	105	6	53	23	1	2	....	6	31	1	46
	Class No. 8.																									
1	Auto transportation (passenger)	1	$ 16 94	$ 4 23	6.00	$3 08	1	..	....	1	....	56	....	1	....	....	....	....	....	..	..	....	....	....	....	..
2	Electric light and power plants (construction and operation)	3	142 87	18 87	14.83	4 44	3	..	3	....	....	39	....	2	1	....	....	....	....	..	..	....	....	....	....	..
3	Electric railways (construction)	1	255 93	131 48	60.00	5 62	1	..	1	....	....	42	....	....	1	....	....	....	....	..	..	....	....	....	....	..
4	Electric railways (operation and maintenance)	48	5,509 29	56 45	32.31	4 59	48	..	35	13	....	42	9	35	12	1	....	....	....	..	..	....	....	....	....	..
6	Gasworks (construction or extension of plant)	5	343 65	32 60	22.20	3 17	5	..	5	....	....	38	....	2	....	....	....	1	....	..	..	....	....	....	....	2
6A	Gasworks (operation and maintenance)	6	205 58	13 80	12.17	3 21	6	..	5	1	....	33	....	4	....	1	....	1	....	..	..	....	....	....	....	..
8	Operating motion-picture machine	1	166 50	86 16	63.00	3 33	1	..	....	1	....	27	....	1	....	....	....	....	....	..	..	....	....	....	....	..
10	Railway express and delivery	2	142 00	24 06	19.50	3 25	2	..	1	1	....	21	....	1	1	....	....	....	....	..	..	....	....	....	....	..
11	Steam-railways (construction and operation)	96	10,451 11	53 35	28.01	4 22	96	..	51	43	2	37	1	27	11	21	....	7	6	..	3	6	4	8	....	3
12A	Telegraph systems (operating)	3	105 90	21 17	19.16	2 14	3	..	1	2	....	19	....	3	....	....	....	....	....	..	..	....	....	....	....	..
12B	Telegraph systems (line-work and construction)	2	91 49	17 59	13.75	4 58	2	..	1	....	1	41	..	1	....	1	....	....	....	..	..	....	....	....	....	..
13A	Telephone systems (operating only)	8	500 31	28 70	16.56	4 03	7	1	7	1	....	34	....	5	2	1	....	....	....	..	..	....	....	....	....	..
13B	Telephone systems (line-work and construction)	8	1,327 12	82 38	43.20	4 56	8	..	5	3	....	38	....	4	....	4	....	....	....	..	..	....	....	....	....	..
14	Theatre stage (operating)	1	293 12	153 77	77.00	4 58	1	..	1	....	....	50	....	1	....	....	....	....	....	..	..	....	....	....	....	..
		185	$19,551 81	.....	.....	.....	184	1	116	66	3	....	10	87	28	29	....	9	6	..	3	6	4	8	....	5
	Class No. 9.																									
1	Navigation	53	$ 7,059 83	$68 01	34.30	$3 78	53	..	17	35	1	34	1	33	7	4	....	....	....	..	..	1	1	4	....	3
2	Stevedoring	239	26,721 70	55 99	31.29	3 71	239	..	153	85	1	40	3	164	26	14	....	12	1	..	..	....	....	9	....	13
3	Wharves (operating)	31	4,019 08	63 71	36.26	4 32	31	..	27	4	....	40	....	21	....	1	....	1	2	..	2	2	....	1	....	1
4	Salving	3	249 56	45 59	19.66	4 29	3	..	2	1	....	44	....	2	....	....	1	....	....	..	..	....	....	....	....	..
		326	$38,050 17	.....	.....	.....	326	..	199	125	2	....	4	220	33	19	1	13	3	..	2	3	1	14	....	17
	Class No. 10.																									
1	Canadian Pacific Railway (construction and operating)	259	$25,762 72	$48 64	31.82	$3 78	259	..	177	81	1	39	16	151	44	13	....	7	4	..	5	16	2	6	2	9
2	Canadian Pacific Ocean Services, Ltd.	13	1,824 75	71 92	48.61	3 13	13	..	6	6	1	37	...	8	1	2	....	....	....	..	..	1	....	1	....	..
3A	Consolidated Mining & Smelting Co., Ltd. (mining)	91	10,419 83	60 25	30.86	4 15	91	..	55	35	1	37	3	37	15	5	1	15	5	..	4	....	....	7	....	2
3B	Consolidated Mining & Smelting Co., Ltd. (smelting)	208	22,879 17	54 56	29.63	4 01	208	..	119	86	3	37	11	70	22	7	1	73	3	..	21	....	....	7	....	4
3C	Consolidated Mining & Smelting Co., Ltd. (reduction)	19	1,958 74	54 56	26.74	3 80	19	..	9	9	1	41	1	3	4	1	....	8	....	..	3	....	....	....	....	..
3D	Consolidated Mining & Smelting Co., Ltd. (quarrying)	2	127 40	29 01	18.00	3 65	2	..	....	2	...	27	....	....	....	....	....	2	....	..	..	....	....	....	....	..
4	Dominion Express Co	8	324 59	16 29	12.12	3 64	8	..	6	2	....	35	2	7	1	....	....	....	....	..	..	....	....	....	....	..
5	Esquimalt & Nanaimo Railway Co	17	1,164 47	33 05	20.38	2 96	17	..	13	4	....	34	....	7	4	....	....	....	....	..	..	6	....	....	....	..
6	Kettle Valley Railway Co	20	2,167 31	53 62	26.90	3 64	20	..	9	11	....	35	2	10	5	1	....	1	....	..	..	....	2	....	....	1
7	West Kootenay Power & Light Co	3	462 25	77 87	36.50	4 17	3	..	2	1	....	45	....	1	1	....	1	....	....	..	..	....	....	....	....	..
8	Coast Copper Co	1	1,712 00	1,060 40	428.00	4 00	1	..	....	1	....	32	....	1	....	....	....	....	....	..	..	....	....	....	....	..
		641	$68,803 23	.....	.....	.....	641	..	396	238	7	....	35	295	97	29	3	106	12	..	33	23	4	21	2	16
	Class No. 11.																									
2	Grand Trunk Pacific Coast Steamship Co	2	$ 313 98	$80 30	51.00	$3 70	2	..	1	1	....	34	....	1	1	....	....	....	....	..	..	....	....	....	....	..
4	Grand Trunk Pacific Co. (construction and operation)	32	3,034 78	47 45	31.97	3 60	32	..	16	16	....	38	6	19	5	1	....	1	2	..	3	1	....	....	....	..
5B	Grand Trunk Pacific Telephone Co.	1	57 90	25 48	19.00	3 86	1	..	..	1	....	37	....	1	....	....	....	....	....	..	..	....	....	....	....	..
		35	$3,406 66	.....	.....	.....	35	..	17	18	....	....	6	21	6	1	....	1	2	..	3	1	....	....	....	..

TABLE B.—ANALYSIS OF 8,841 TEMPORARY TOTAL DISABILITY ACCIDENTS—*Concluded.*

Sub-class.	Industry.	No. of Accidents.	Total Wage Loss.	Average Time Lost paid.	Average Duration of Disability in Days.	Average Daily Wage.	Sex.		Conjugal State.			Average Age.	Received other Benefits.	Nationality.												
							Male.	Female.	Married.	Single.	Unknown.			British.	Canadian.	American.	French.	Italian.	Russian.	German.	Austrian.	Chinese.	Japanese.	Scandinavian.	Natives of India.	Others.
	Class No. 12.																									
1	Canadian Northern Pacific Rly. Co.	82	$8,352 50	$57 13	28.72	$3 65	82	..	40	42	....	35	12	36	19	8	1	6	....	..	3	1	....	....	....	8
	Class No. 13.																									
1	Provincial Government employees.	26	$3,687 27	$72 28	37.77	$4 34	26	..	13	12	1	43	....	16	5	2	....	....	....	..	..	....	....	1	....	2
	Class No. 14.																									
	Municipalities—																									
1	Parkmen	4	$ 548 00	$65 23	36.50	$4 31	4	..	2	2	....	47	....	4	....	....	....	....	....	..	..	....	....	....	....	..
2	Paid fire department	21	1,843 14	42 15	26.76	3 59	21	..	11	10	....	29	3	19	1	1	....	....	....	..	..	....	....	....	....	..
3	Police department	5	364 24	31 97	17.10	4 42	5	..	4	1	....	34	2	5	....	....	....	....	....	..	..	....	....	....	....	..
4	Street cleaning and scavenging	12	1,041 86	42 88	32.50	3 68	12	..	10	1	1	46	....	12	....	....	....	....	....	..	..	....	....	....	....	..
5A	Waterworks maintenance	4	255 89	28 67	22.25	3 93	4	..	3	1	....	47	....	3	1	....	....	....	....	..	..	....	....	....	....	..
5B	Waterworks construction	2	114 00	26 40	23.00	3 00	2	..	1	1	....	59	....	2	....	....	....	....	....	..	..	....	....	....	....	..
7A	Sewers, maintenance	3	431 57	74 09	55.00	3 05	3	..	2	1	....	43	....	1	....	....	....	1	....	..	..	....	....	1	....	..
7B	Sewers, construction	1	101 50	50 06	39.00	3 50	1	..	....	1	....	54	....	1	....	....	....	....	....	..	..	....	....	....	....	..
8A	Road-making, without blasting	18	1,503 83	40 01	30.97	3 59	18	..	16	2	....	48	4	11	3	....	....	2	....	..	..	....	....	....	....	2
8B	Road-making with blasting	3	76 12	8 87	10.00	3 08	3	..	2	1	....	48	....	3	....	....	....	....	....	..	..	....	....	....	....	..
9	Street-paving	2	78 25	15 66	15.25	3 55	2	..	1	....	1	50	....	2	....	....	....	....	....	..	..	....	....	....	....	..
11A	Electric railways, operating	1	136 00	68 20	41.00	4 00	1	..	1	....	....	41	....	....	....	....	....	....	....	..	..	....	....	1	....	..
12	Light and power plants	3	182 94	27 36	19.16	3 40	3	..	2	1	....	37	....	2	1	....	....	....	....	..	..	....	....	....	....	..
14	Ferries	5	456 56	42 21	20.50	4 84	5	..	4	1	....	45	....	3	2	....	....	....	....	..	..	....	....	....	....	..
		84	$7,133 90	.....	.....	.....	84	..	59	23	2	....	9	68	8	1	....	3	....	..	..	....	....	2	....	2
	Class No. 15.																									
1	Canning and packing of fish	94	$10,165 15	$ 53 14	30.01	$4 25	87	7	47	44	3	37	3	44	13	6	....	4	2	..	..	7	10	3	....	5
2	Fish oil and fertilizer manufacturing	3	1,344 92	242 18	90.83	5 11	3	..	2	1	....	46	....	2	1	....	....	....	....	..	..	....	....	....	....	..
4	Fishing or whaling	37	3,874 96	49 30	27.44	4 42	37	..	19	17	1	38	....	16	7	1	....	....	2	..	..	1	5	3	....	2
5	Kelp-collecting	3	550 20	92 51	41.50	5 06	3	..	2	1	....	48	....	1	1	....	....	....	....	..	..	....	....	....	....	1
		137	$15,935 23	.....	.....	.....	130	7	70	63	4	....	3	63	22	7	....	4	4	..	..	8	15	6	....	8
	Class No. 16.																									
1	Explosives-manufacturing	67	$5,983 80	$44 09	22.18	$4 01	64	3	33	33	1	45	....	39	10	2	....	7	....	..	..	6	....	1	....	2
4	Chemicals	12	458 31	15 12	10.92	3 56	12	..	6	5	1	35	....	5	1	....	....	1	1	..	..	2	2	....	....	..
		79	$6,442 11	.....	.....	.....	76	3	39	38	2	....	....	44	11	2	....	8	1	..	..	8	2	1	....	2

TABLE B 2.—SUMMARY OF TABLE B.

Total wage loss		$944,722.90
Conjugal state—		
Married	4,765	
Single	3,818	
Unknown	258	
		8,841
Sex—		
Male	8,735	
Female	106	
		8,841
Receiving other benefits		590
Nationalities—		
British	4,164	
Canadian	1,209	
American	598	
French	29	
Italian	474	
Russian	315	
German	32	
Austrian	201	
Chinese	577	
Japanese	473	
Scandinavian	343	
Natives of India	106	
Others	320	
		8,841

TABLE C.—STATEMENT SHOWING THE CAUSE OF ALL FINALLED ACCIDENTS DURING 1918.

Cause of Accidents.	CLASS NO. OF TEMPORARY TOTAL DISABILITY ACCIDENTS.																T.T.D.		P.P.D.	Fatals.	Total.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	No. of Accidents.	Payments.			
Prime Movers.																					
Steam-engines	6	....	..	2	....	....	1		3	1	1	3	...	....	1	....	18	$ 1,834 87	$ 246 16	$ 8,242 82	$10,323 85
Electric motors and dynamos	.. ...	....	2	...	...	....	.....	....	....	....	....	....	....	..	....	....	2	12 54	.....	... .	12 54
Gas or gasolene engines	5	....	....	....	....	....	1	....	....	....	....	....	....	....	1	....	7	956 91	47 24	.....	1,004 15
All other prime movers	.....	....	....	....	....	....	...	...	....	....	....	....	....	....	....	...	....	2 80	.....	.....	2 80
Power-transmission Apparatus.																					
Shafts, including pulleys	13	1	1	1	....	2	1	....	...	3	....	1	....	....	....	....	23	2,392 57	4,900 03	9,941 22	17,233 82
Set-screws	.....	1	1	...	1	1	.....	....	....	1	....	....	....	....	....	....	5	279 15	2,300 00	.....	2,579 15
Belts	9	3	1	3	2	3	1	....	....	7	....	....	....	....	2	....	31	3,025 82	.....	2,931 36	5,957 18
Chains and sprockets	12	....	....	....	....	....	.....	....	....	....	....	....	....	....	....	....	12	298 70	.....	.....	298 70
Cables	1	....	....	1	....	....	.....	....	....	....	....	....	....	....	....	....	2	227 16	.....	44,885 88	45,113 04
Gears	15	2	2	3	3	4	5	....	1	....	....	....	....	....	2	1	38	1,906 03	2,348 27	.....	4,254 30
All other transmission apparatus	.....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1	27 23	.....	.....	27 23
Power-working Machinery.																					
Earthenware and brick manufacturing	.....	...	....	1	....	....	.....	....	....	2	....	....	....	....	....	....	3	942 11	326 35	.....	1,268 46
Cement-mixing machinery	.....	....	...	1	....	....	.....	....	....	....	....	....	....	....	....	....	1	86 35	....	.....	86 35
Cement-mixers	.....	....	....	1	....	....	.....	....	....	....	....	....	....	....	....	....	1	35 06	.....	.....	35 06
Glass making or working	.....	....	....	....	....	1	....	....	....	2	....	....	....	....	....	....	3	23 71	.....	.....	23 71
Stone cutting, rubbing, or polishing machinery	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.....	87 10	... .	87 10
Metal-working—																					
Abrasive wheels	1	....	1	3	3	1	8	....	...	2	....	...	....	....	....	....	19	779 27	210 04	... .	989 31
Milling and drilling machine	2	....	2	30	7	....	18	....	....	4	....	....	....	1	....	....	64	2,718 14	1,237 94	.....	3,956 08
Power-hammers	.....	....	....	....	4	....	2	....	....	....	....	....	....	....	....	....	6	297 70	278 67	.....	576 37
Lathes	1	....	....	....	6	...	1	1	....	....	....	1	....	....	....	....	10	240 78	2,442 11	.....	2,682 89
Planers	1	6	....	1	1	...	6	....	....	....	1	....	....	....	....	....	16	1,195 05	1,146 19	.....	2,341 24
Riveters	.....	....	....	....	2	....	19	....	....	2	....	....	....	....	....	....	23	508 20	600 00	.....	1,108 20
Welding and heat cutting	.....	....	....	....	....	....	.....	....	....	....	....	....	....	....	....	....	....	.....	.....	.....	....
Can-making machinery	.....	....	....	....	31	2	.....	....	....	....	....	....	....	....	4	....	37	799 01	902 58	.....	1,701 59
All other metal-working machinery	1	1	...	4	12	....	3	....	....	3	....	....	....	....	....	....	24	585 79	184 49	.....	770 28
Wood-working—																					
Shingle-machines	166	....	....	....	....	....	.....	....	....	....	....	....	....	....	....	....	166	11,675 08	15,551 19	.....	27,226 27
Sawmill-machines	219	7	1	....	..	....	.....	..	....	..	....	....	....	....	....	....	227	12,735 51	23,571 70	4,628 90	40,936 11
Portable power-saws	1	1	....	....	....	1	1	....	....	....	....	....	....	....	....	....	4	182 97	.....	.....	182 97
All other power-saws	8	49	1	2	3	1	21	....	....	1	....	....	....	1	....	....	87	3,308 31	5,296 11	2,823 20	11,427 62
Edgers	.....	1	1	....	....	....	.....	....	....	1	....	....	....	....	....	....	3	321 27	.....	.....	321 27
Planing-mill machinery	4	16	....	....	....	1	2	....	....	....	....	....	....	....	....	....	23	650 73	689 95	4,447 23	5,787 91
Cooperage machinery	.....	3	....	....	....	....	.....	....	....	....	....	....	....	....	....	....	3	87 18	.....	.....	87 18
All other wood-working machinery	4	24	....	....	....	2	1	1	....	....	....	....	....	....	....	....	32	804 24	465 29	.....	1,269 53
Paper-making machinery	44	....	....	....	....	3	.....	....	....	....	....	....	....	....	....	....	47	1,469 60	754 79	3,637 26	5,861 65
Printing-presses, etc	1	....	....	....	....	12	.....	....	....	....	....	....	....	....	....	....	13	354 90	1,166 37	.....	1,521 27
Leather-working machinery	.....	...	....	....	....	1	.....	....	....	....	....	....	....	....	....	....	1	51 64	.....	.....	51 64
Textile and laundry machines	1	....	....	....	....	9	.....	....	....	1	....	....	....	....	....	....	11	146 40	.....	.....	146 40
Baking-machines	.....	....	....	....	....	....	.....	....	....	....	....	....	....	....	....	....	....	.....	220 41	.....	220 41
Confectionery and sugar-refining machinery	.....	..	....	....	....	3	.....	....	....	....	....	....	....	....	....	....	3	258 95	.....	.....	258 95
Food-products machinery	.....	....	....	....	....	19	...	....	....	....	....	....	....	....	....	....	19	460 36	853 88	.....	1,314 24
Shipyard machinery (N.E.S.)	.....	....	....	....	....	....	30	....	....	....	....	....	....	....	....	....	30	1,174 94	2,184 23	.....	3,359 17
All other power-working machinery	3	2	3	1	2	14	2	1	....	3	....	....	....	....	1	....	32	1,560 22	3,196 61	.....	4,756 83

Hoisting Apparatus and Conveyors.																				
Log. operations (hoisting and conveying apparatus)	159	....	2	....	....	....	3	....	....	1	....	....	....	....	....	....	165	$ 12,752 04	$ 5,055 66	$ 3,589 27	$ 21,396 97
Elevators (not construction)	1	1	1	2	2	13	....	....	1	2	....	....	....	....	....	....	23	1,685 59	.....	.....	1,685 59
Construction elevators, etc	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	128 13	49 06	.....	177 19
Cranes and derricks	15	....	3	3	8	1	45	2	21	8	1	....	1	....	....	....	108	8,212 98	3,322 32	75 00	11,610 30
Blocks, tackles, capstans, winches, cables, etc. (N.E.S.)	49	....	8	11	5	3	27	1	19	6	....	....	3	....	1	1	134	9,913 76	6,425 62	150 00	16,489 38
All other hoising apparatus and conveyors	15	2	5	3	1	....	2	....	4	2	1	....	....	1	....	2	38	1,769 79	1,287 74	75 00	3,132 53
Miscellaneous Machinery.																				
Pumps	1	....	1	1	....	....	....	....	1	....	....	....	....	....	....	....	4	616 95	1,711 80	....	2,328 75
Air-fans	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	199 35	2,711 17	.....	2,910 52
Pile-drivers	....	....	....	....	....	....	1	....	....	1	....	1	....	....	....	....	3	316 62	.....	.....	316 62
All other miscellaneous machinery	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	2	225 51	39 36	.....	264 87
Boilers and Steam-pressure Apparatus.																				
Steam-boilers (all accidents)	4	....	1	....	2	....	1	1	1	....	....	....	....	....	....	....	10	566 61	.....	.....	566 61
Steam-pipes or water-gauges	....	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	2	34 34	.....	.....	34 34
Other steam-pressure apparatus	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	7 25	.....	.....	7 25
Vehicles and Water Transportation.																				
Train wrecks, collisions, etc	4	1	....	....	....	....	....	6	....	4	3	2	....	....	....	....	20	1,920 60	311 76	75 00	2,307 36
Falls from trains or locomotives	1	....	1	....	....	....	....	3	....	27	2	3	....	....	....	....	37	2,533 29	5,509 20	12,441 59	20,484 08
Struck by or run over by train	1	....	....	1	....	....	2	2	....	6	1	3	....	....	....	1	17	1,790 54	813 38	8,794 59	11,398 51
Coupling railway-cars	2	....	2	....	....	....	....	2	....	8	....	....	....	....	....	....	14	762 54	.....	10,443 01	11,205 55
Other railway causes	3	....	....	1	....	....	....	16	2	32	8	9	1	....	....	....	72	3,268 39	1,879 78	7,379 29	12,527 46
Street-railway collisions, etc	....	....	....	....	....	3	....	2	....	1	....	1	1	1	....	....	9	473 73	.....	16,320 02	16,793 75
Falls from street-cars	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	2	60 17	.....	.....	60 17
Struck by or run over by street-cars	....	....	....	....	1	1	1	....	....	....	....	....	....	....	....	....	3	163 87	.....	3,979 55	4,143 42
All other street-car causes	....	....	....	....	....	....	....	3	....	....	....	1	....	....	....	....	4	128 46	504 71	.....	633 17
Logging railways or locomotives	35	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	37	1,992 54	3,535 95	4,988 09	10,516 58
Mine, quarry, other cars or locomotives	21	2	249	61	1	....	....	5	1	26	....	....	....	....	....	5	371	26,516 54	5,226 54	16,556 85	48,299 93
Hand-trucks, barrows, etc	35	6	5	6	3	11	14	6	15	13	....	....	....	....	1	2	117	3,472 18	249.05	.....	3,721 23
Automobiles and motor-cycles (collisions)	1	....	....	....	1	3	1	....	....	1	....	....	....	1	....	....	8	187 80	.....	4,047 59	4,235 39
Automobiles and motor-cycles (skids and side-slips)	2	....	....	....	1	3	....	....	....	....	....	....	....	....	....	....	6	335 40	.....	.....	335 40
Automobiles and motor-cycles (back-fire while cranking engine)	5	2	3	....	10	17	2	2	....	....	....	....	....	5	1	....	47	1,773 16	.....	.....	1,773 16
Automobiles and motor-cycles (all other accidents)	4	1	....	....	5	13	3	6	1	2	....	....	....	2	....	1	38	1,230 44	.....	.....	1,230 44
Animal-drawn vehicles	35	....	15	3	....	28	6	....	1	4	....	....	....	9	....	....	101	6,673 37	2,346 75	6,863 86	15,883 98
Vehicles (N.E.S.)	....	....	....	1	1	3	....	....	....	....	....	....	1	....	....	....	6	134 25	.....	.....	134 25
Water transportation (accidents incidental thereto)	2	....	....	1	....	1	....	....	5	5	....	....	....	....	3	....	17	625 51	.....	5,299 79	5,925 30
Explosives, Electricity, Fire, etc.																				
Explosives (manufacturing and storing)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	10 41	.....	75 00	85 41
Explosives (blasting accidents)	4	....	2	5	1	....	1	3	....	1	....	1	....	1	....	....	19	3,134 47	500 00	75 00	3,709 47
Explosives (other causes)	2	....	....	4	....	....	1	1	....	2	....	....	....	....	....	3	13	792 89	3,711 90	.....	4,504 79
Explosives (mines only, coal, etc.)	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	2	38 09	.....	2,793 59	2,831 68
Explosions of molten metals	2	....	....	....	4	....	....	....	....	2	....	....	....	....	....	....	8	324 51	360 00	.....	684 51
Molten metals (other accidents)	2	....	1	5	14	....	5	....	....	10	....	....	....	....	....	....	37	2,972 38	.....	.....	2,972 38
All other explosions, except steam	5	1	1	5	3	4	2	....	....	4	....	2	....	2	1	....	30	1,124 59	40 79	3,870 39	5,035 77
Electricity	2	....	....	1	1	4	1	4	....	2	....	....	....	2	....	....	17	1,578 65	2,112 94	13,033 82	16,725 41
Fires	....	....	....	....	2	....	....	....	2	1	....	....	....	....	1	....	6	290 03	.....	2,551 90	2,841 93
Forest fires	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	528 09	.....	.....	528 09
Fire and heat (N.E.S.)	13	1	3	2	6	4	28	2	....	2	1	....	....	....	....	....	62	1,460 27	.....	4,882 04	6,342 31
Scalding water, steam, etc	11	....	....	2	....	4	4	1	3	3	....	2	....	....	5	....	35	1,219 91	.....	3,131 80	4,351 71
Hot asphalt, pitch, or tar	1	....	....	....	....	....	11	....	....	....	....	....	....	1	4	1	18	764 30	.....	.....	764 30
Carried forward	956	134	619	174	150	197	285	74	81	211	19	30	7	27	28	18	2,714	$159,127 54	$118,904 18	$213,029 91	$491,070 63

TABLE C.—STATEMENT SHOWING THE CAUSE OF ALL FINALLED ACCIDENTS DURING 1918—*Concluded.*

Causes of Accidents.	CLASS NO. OF TEMPORARY TOTAL DISABILITY ACCIDENTS.																T.T.D.		P.P.D.	Fatals.	Totals.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	No. of Accidents.	Payments.			
Brought forward	956	134	619	174	150	197	285	74	81	211	19	30	7	27	28	18	2,714	$159,127 54	$118,904 18	$213,029 91	$491,070 63
Explosives, Electricity, Fire, etc.—Concluded.																					
Acids and caustics	1	....	....	....	5	3	3	....	4	6	....	...	....	....	3	11	36	816 55	262 86	....	1,079 41
Lime	.....	....	1	....	....	1	1	....	....	....	....	....	....	....	...	....	3	67 95	.....	.....	67 95
Falls of Persons.																					
From scaffolds and stagings	10	1	1	3	1	1	70	1	3	3	....	....	....	....	1	....	95	5,224 11	111 93	$ 5,071 03	10,407 07
Collapse of scaffold	8	....	2	2	2	2	27	2	....	2	....	....	....	....	1	1	49	3,871 71	5,253 86	.....	9,125 57
Collapse of support	9	....	1	....	....	1	11	1	1	3	1	....	....	....	4	....	32	3,166 04	... .	.....	3,166 04
From ladders	10	1	....	5	2	5	19	2	6	7	....	....	....	1	4	....	62	5,021 07	846 26	75 00	5,942 33
From machinery or trucks	12	....	2	1	....	3	1	...	1	3	....	1	....	....	....	....	24	1,060 83	.....	2,869 89	3,930 72
From boats and vessels under construction	.....	....	....	....	....	....	30	....	....	1	....	....	....	....	....	....	31	2,000 98	.....	2,888 69	4,889 67
From buildings under construction or demolition	3	....	....	....	....	....	7	....	....	1	....	....	....	....	....	....	11	1,033 91	.....	.....	1,033 91
All other falls from a height	90	2	5	14	....	10	23	6	10	11	....	2	....	3	6	3	165	13,265 55	1,184 76	19,069 73	33,520 04
Into excavations, pits, shafts	10	1	....	5	1	2	17	2	6	3	1	....	....	1	....	1	50	2,080 51	.....	4,575 40	6,655 91
Into hot liquids, vats, etc	.....	....	....	....	....	....	1	....	....	8	....	....	....	....	....	....	9	410 50	.....	75 00	485 50
Falls (slipping or stumbling)	213	6	61	52	20	52	185	19	35	47	4	7	3	13	11	10	738	34,413 54	4,638 44	2,853 95	41,905 93
All other falls of persons	5	....	1	2	....	3	4	....	....	2	....	....	....	....	....	....	17	1,450 82	129 66	3,835 03	5,415 51
Falling, Rolling, or Moving Objects.																					
Falling overhead coal or rock (in mine)	2	....	208	131	1	....	.....	1	....	14	....	....	....	....	....	....	357	25,698 36	12,928 60	32,769 22	71,396 18
Falling overhead coal or rock (not in mine)	3	....	3	11	....	....	4	2	3	8	....	4	1	2	4	....	45	2,979 60	697 00	150 00	3,826 60
Falling overhead material (not in mine)	4	....	2	1	1	....	3	....	2	2	....	....	....	....	....	....	15	631 74	.....	.....	631 74
Falling timber, lumber, etc	213	9	36	13	4	4	169	9	10	10	....	1	....	6	5	1	490	24,120 54	6,202 12	19,182 70	49,505 36
Falling trees	123	....	1	2	....	1	1	....	....	....	....	....	....	1	....	....	129	14,021 65	8,599 71	22,966 18	45,587 54
Rolling or moving logs	228	1	9	....	1	....	21	1	2	5	2	1	1	....	1	....	273	23,529 80	5,389 84	8,944 53	37,864 17
Slide or cave-in	.....	....	3	2	.. ..	....	1	1	....	1	....	1	1	2	....	1	13	1,062 29	.....	....	1,062 29
Snowslide	.....	....	1	3	....	...	.....	....	....	3	....	....	....	....	....	....	7	990 42	.....	230 00	1,270 42
Flying objects	99	12	18	41	23	11	137	3	3	15	....	7	2	2	8	2	383	14,628 33	21,986 66	75 00	36,689 99
Falling objects from trucks	45	1	7	5	4	14	18	1	12	11	....	....	....	....	....	....	118	5,663 81	62 88	3,759 24	9,485 93
Other falling, rolling, or moving objects	73	1	22	47	35	40	170	11	40	41	2	4	1	2	12	6	507	23,012 59	5,776 68	14,170 98	42,960 25
Miscellaneous.																					
Handling lumber, timber, etc	131	10	29	6	2	7	78	1	19	8	....	1	....	3	1	....	296	10,890 67	1,296 75	.....	12,187 42
Handling heavy machinery, etc	42	3	36	34	29	33	77	15	44	46	1	9	....	1	9	4	383	13,219 14	1,121 06	925 92	15,266 12
Handling wire cables, etc	53	2	9	9	9	11	32	3	12	5	....	....	....	....	4	1	150	5,025 47	3,900 22	1,457 25	10,382 94
Lifting	9	.	23	6	6	8	19	1	9	9	....	2	....	....	2	1	95	3,221 84	.....	75 00	3,296 84
Caught on or struck against nail or sharp projection	70	5	23	14	20	33	75	7	8	18	1	2	....	5	10	1	292	7,443 65	1,044 28	2,189 96	10,677 89
Doors shutting	4	....	3	1	1	3	1	2	1	3	....	....	....	1	1	...	21	857 96	36 29	.....	894 25
Cut by glass	.....	....	....	....	....	15	4	1	1	3	....	1	....	1	1	....	28	559 24	.....	.....	559 24
Cut by axe, adze, etc	230	2	16	13	2	2	40	4	2	4	1	....	6	2	4	....	328	14,466 26	2,560 10	.....	17,026 36
Injured by pick or peavy	39	....	8	3	....	....	7	....	2	2	....	2	....	1	....	...	64	2,354 51	.....	.....	2,354 51
Hand-saws	76	1	7	2	....	....	5	....	....	1	....	1	....	....	....	....	93	2,689 30	.....	.....	2,689 30
Stepping on nail, etc	14	1	9	1	3	2	24	2	2	2	....	....	....	....	1	....	61	772 67	.....	.....	772 67
Inhalation of poisonous gas	.....	....	1	1	....	1	1	....	....	3	....	....	....	....	1	5	13	223 00	.....	8,455 51	8,678 51

| | | |

TABLE D.—TABLE COVERING 8,841 TEMPORARY TOTAL DISABILITY ACCIDENTS, SHOWING NATURE OF INJURY AND CLASS, 1918.

No. of Accidents.	Location of Injury. Part of Body.	Left.	Right.	Both.	Infected.	Foreign Body in Eye.	Nature of Injury. Bruise or Crush.	Cut or Laceration.	Puncture.	Sprain or Strain.	Fracture.	Dislocated.	Amputated.	Scald or Burn.	Miscellaneous.	Class No. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
32	Abdomen	....	....	....	....	....	20	....	....	10	....	1	....	1	....	10	....	8	1	3	4	3	1	1	....	....	1	....	....	....	....
431	Ankle	229	202	....	1	....	74	26	....	280	36	7	....	5	....	16	....	49	29	3	19	88	3	22	43	2	4	1	3	2	2
361	Arm	170	184	7	14	....	83	64	18	36	123	1	4	32	....	136	12	32	20	18	31	49	12	10	25	1	4	1	3	5	2
308	Back	....	....	....	3	....	152	4	3	202	4	....	....	3	....	97	3	62	36	11	12	76	7	19	33	4	3	2	1	5	3
20	Brain	....	....	....	....	....	....	....	....	....	....	....	....	..	20	9	....	....	4	....	1	3	....	....	2	....	....	....	....	....	1
3	Buttock	....	....	....	....	....	1	1	....	....	....	....	....	1	....	1	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....
71	Chest	....	....	....	....	....	58	2	1	7	1	..	....	2	....	31	....	16	5	1	2	4	....	4	5	....	1	....	1	1	....
16	Ear	11	5	....	....	....	4	6	2	....	....	....	....	2	2	6	1	...	4	1	1	1	2	....	....	....	....	....	....	....	....
51	Elbow	21	28	2	4	....	21	13	4	5	4	4	....	....	....	18	....	8	5	2	2	10	2	....	3	....	....	1	....	....	....
421	Eyes	207	191	23	3	253	39	71	20	....	....	....	....	38	253	86	7	31	45	36	10	154	6	3	18	1	5	2	2	10	5
206	Face	....	....	....	3	....	30	107	1	....	28	1	....	39	....	81	1	18	23	5	9	31	5	7	9	1	4	1	4	2	5
1,499	Fingers	768	731	....	147	....	429	650	74	7	145	12	161	21	....	522	94	148	108	87	126	226	26	38	77	1	9	1	12	20	4
767	Foot	357	398	12	17	....	313	165	85	58	119	1	3	23	....	259	5	82	53	30	31	186	14	30	47	4	5	5	5	9	2
17	Groin	3	6	8	....	....	9	2	....	6	....	....	....	....	....	2	....	2	....	1	....	5	2	2	2	....	1	....	....	....	....
707	Hand	317	349	41	124	....	162	300	107	12	34	1	4	65	22	216	21	92	7	40	60	138	10	39	42	1	7	1	8	21	4
19	Hernia	....	....	....	....	....	....	....	....	....	....	....	....	....	19	8	....	7	....	....	1	2	....	1	....	....	....	....	....	....	....
328	Head	....	....	....	5	....	52	234	4	....	35	....	....	3	....	101	5	34	35	7	18	71	5	11	22	3	3	1	5	4	3
80	Hip	44	29	7	....	....	53	4	3	10	4	4	....	2	....	19	..	13	12	2	5	11	3	6	5	1	1	....	1	....	1
421	Knee	191	216	14	18	....	189	72	26	108	8	17	....	1	....	133	1	43	32	6	19	91	14	27	32	5	4	1	6	6	1
703	Leg	318	357	28	25	....	300	134	19	26	204	....	5	15	....	299	6	38	66	13	30	125	18	24	41	4	8	3	7	13	8
153	Multiple injuries	....	....	....	1	....	105	11	....	2	16	....	....	19	....	47	....	12	12	7	10	30	3	2	10	2	2	2	4	6	4
21	Neck	....	....	....	....	....	8	7	....	4	....	....	....	2	....	4	....	4	4	....	1	5	....	2	1	....	....	....	....	....	....
120	Poisoning	....	....	....	....	....	....	....	....	....	....	....	....	....	120	3	....	1	4	....	2	....	....	....	92	....	....	....	....	1	17
393	Ribs	145	248	....	....	....	55	1	1	6	330	....	....	....	....	142	7	33	27	8	21	81	16	13	19	....	5	2	5	6	8
260	Shoulders	131	112	17	1	....	114	4	1	52	51	36	....	2	....	80	2	47	20	4	14	52	7	11	14	1	4	....	1	2	1
102	Side	50	51	1	....	....	75	2	....	25	....	....	....	....	....	30	2	12	8	3	9	18	2	3	8	....	3	....	2	2	....
118	Thigh	53	61	4	2	....	79	14	4	7	9	....	....	5	....	44	1	20	7	5	6	18	....	4	10	1	1	....	....	....	1
365	Thumb	188	177	....	43	....	87	168	40	10	25	8	25	2	....	102	28	41	33	27	28	47	10	9	22	....	2	....	3	12	1
506	Toes	236	267	3	....	....	277	74	7	3	134	....	10	1	....	148	6	45	40	18	26	129	13	27	35	2	2	2	5	4	4
213	Wrist	97	113	3	10	....	19	55	8	96	22	5	....	8	....	57	....	26	11	10	23	41	4	10	16	1	2	....	5	5	2
69	Miscellaneous	....	....	....	....	....	....	....	....	....	....	....	....	....	69	25	....	8	4	4	4	13	....	1	7	...	1	...	1	1	....
8,841		....	....	....	421	....	2808	2191	428	975	1332	98	212	292	505	2877	202	932	649	352	526	1708	185	326	641	35	82	26	84	137	79

TABLE E.—TABLE COVERING 420 PERMANENT PARTIAL DISABILITY ACCIDENTS, SHOWING NATURE OF INJURY, CLASS, AND COST, 1918.

No. of Accidents.	Particulars of Injury.	Class No. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	Cash Payment and Reserve.	Average Cost per Accident.
5	Ankle impaired	2	....	....	1	....	1	....	....	....	1	....	....	....	....	....	....	$ 2,283 52	$ 456 70
12	Arm amputated	2	....	....	2	....	3	1	1	....	1	....	1	....	....	....	1	30,610 59	2,550 88
17	Arm impaired	10	....	....	2	....	1	....	....	3	1	....	....	....	....	....	....	27,191 57	1,599 50
2	Ear (deaf in one ear)	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	959 42	479 71
25	Eye (loss of sight in one eye)	9	1	2	2	....	1	5	1	....	2	....	....	....	1	1	....	21,566 97	862 67
13	Eye impaired	2	....	2	3	....	....	5	....	....	....	....	....	....	....	....	1	6,566 75	505 13
1	Eye, elbow, and leg impaired	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	5,253 86	5,253 86
148	Finger amputated	64	11	6	10	14	14	14	2	4	6	1	....	....	....	2	....	12,010 10	81 14
35	Fingers (two) amputated	22	2	2	1	1	....	2	....	....	1	....	1	....	....	1	2	6,062 51	173 21
16	Fingers (three) amputated	9	3	....	....	....	....	3	....	....	1	....	....	....	....	....	....	7,827 84	489 24
6	Fingers (four) amputated	2	1	....	1	....	2	....	....	....	....	....	....	....	....	....	....	5,544 68	924 11
1	Hand amputated	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,000 00	1,000 00
32	Hand impaired	20	3	....	1	....	1	5	....	2	....	....	....	....	....	....	....	15,382 97	480 71
6	Facial disfigurement	1	1	1	1	....	....	....	....	....	1	....	1	....	....	....	....	1,520 00	253 33
1	Foot amputated	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1,473 15	1,473 15
2	Foot impaired	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	528 99	264 49
10	Leg amputation	4	....	2	....	....	....	2	1	....	1	....	....	....	....	....	....	16,725 56	1,672 55
19	Leg impaired	8	....	3	2	1	1	1	1	....	1	....	1	....	....	....	....	31,513 63	711 24
3	Spine fractured	....	....	2	....	....	1	....	....	....	....	....	....	....	....	....	....	5,569 88	1,856 62
24	Thumb amputated	10	4	1	2	3	....	....	....	....	3	....	1	....	....	....	....	5,346 06	222 75
10	Thumb and one finger amputated	6	....	1	....	1	....	1	....	....	1	....	....	....	....	....	....	4,534 22	453 42
5	Thumb and two fingers amputated	1	....	....	2	....	....	1	....	....	1	....	....	....	....	....	....	3,604 02	720 80
5	Thumb and three fingers amputated	3	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	4,492 98	898 59
2	Thumb and four fingers amputated	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	2,335 15	1,167 57
3	Thumb and finger impaired	1	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	607 94	202 64
9	Toe amputated	2	....	....	1	1	....	....	....	....	4	....	....	....	....	....	1	521 98	57 99
2	Toes (two) amputated	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	274 36	137 18
2	Toes (three) amputated	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	276 17	138 08
2	Toes (four) amputated	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	390 82	195 41
2	Toes (five) amputated	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	515 31	257 65
420		183	28	22	33	21	25	48	7	10	26	1	5	....	2	4	5	$204,491 00	

BALANCE SHEET (AS AT DECEMBER 31ST, 1918).

			Assets.	*Liabilities.*
Debentures and bonds, cost value			$ 771,816 99	
B.C. Government Bonds, par value	$800,000 00			
Dominion Government Bonds, par value	75,000 00			
	$875,000 00			
Cash—				
Current account			206,716 67	
Reserve account			15,582 97	
Medical aid account			8,274 84	
Reserve for pension awards				787,399 96
Reserve and interest	$870,229 76			
Less pensions paid	82,829 80			
Reserve value, December 31st, 1918	$787,399 96			
Surplus at credit of classes				206,716 67
Surplus at credit of medical aid				8,274 84
			$1,002,391 47	$1,002,391 47

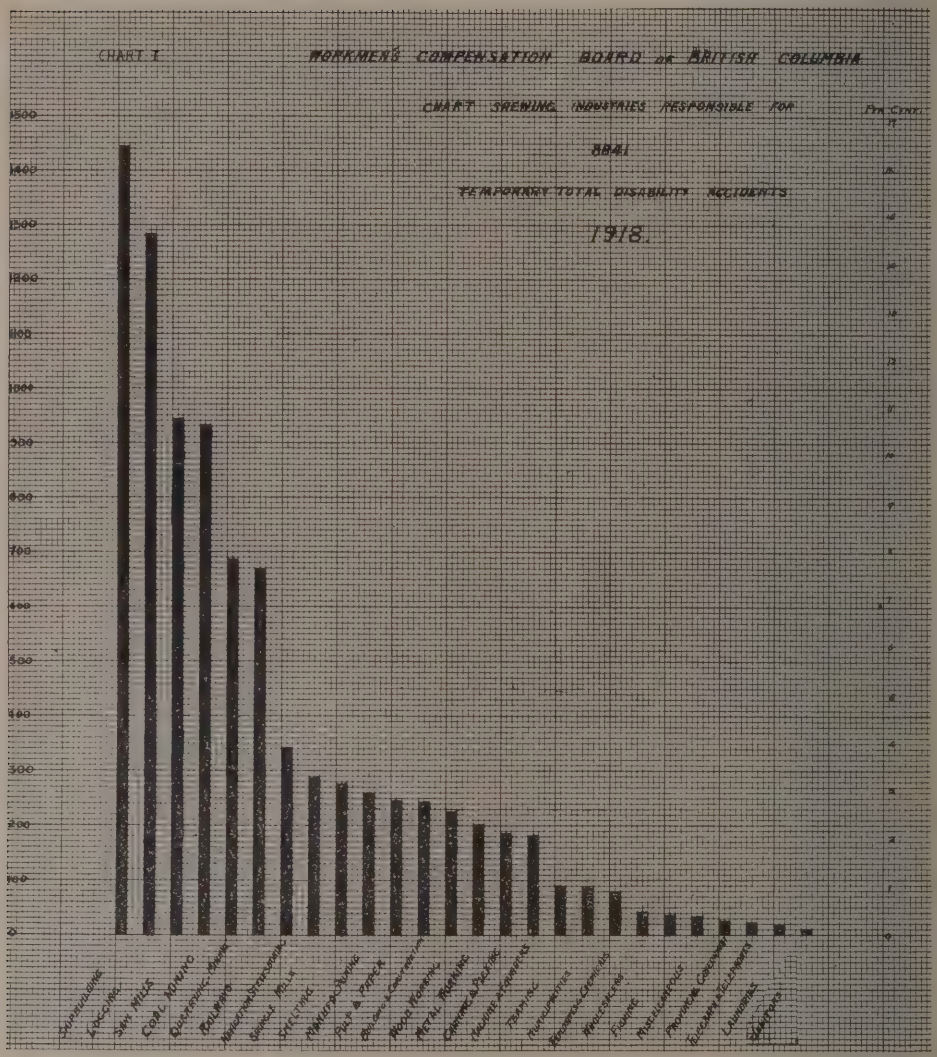


CHART I.
WORKMEN'S COMPENSATION BOARD OF BRITISH COLUMBIA.
CHART SHEWING INDUSTRIES RESPONSIBLE FOR
1918.
TEMPORARY TOTAL DISABILITY ACCIDENTS
Per Cent.
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
LOGGING
SAW MILLS
COAL MINING
QUARRYING & CLAY
BUILDING
MANUFACTURING
SMALL MILLS
SMELTING
CONSTRUCTION
PULP & PAPER
RAILWAY CONSTRUCTION
ROAD WORKS
METAL TRADES
CHEMICAL WORKS
MARINE WORKS
TEXTILE
MISCELLANEOUS
WOODWORKING
MINES
FISHING
MISCELLANEOUS
TRUNKS, CASEMENT
TELEGRAPH & TELEPHONE
LAUNDRIES
BAKERIES

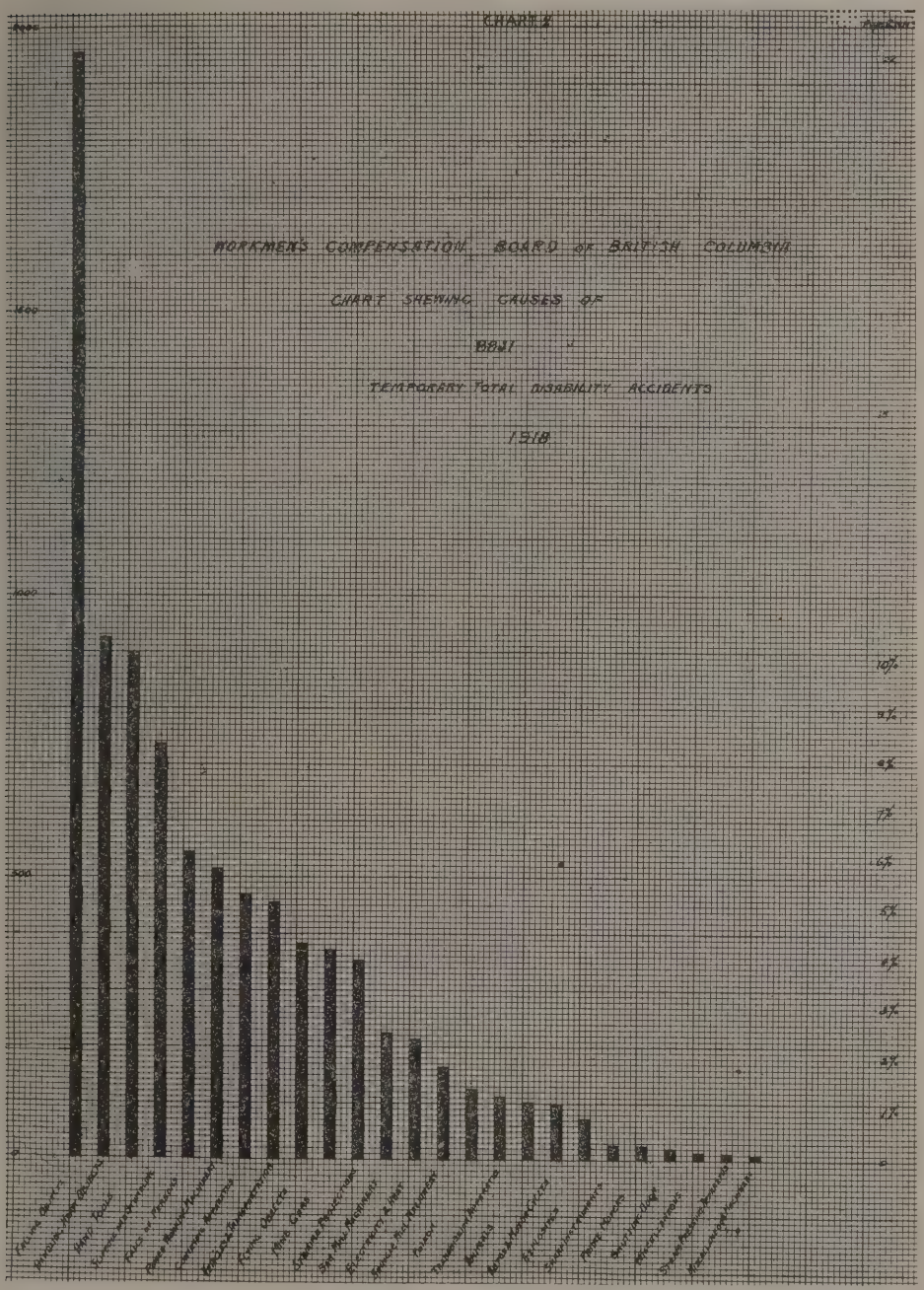
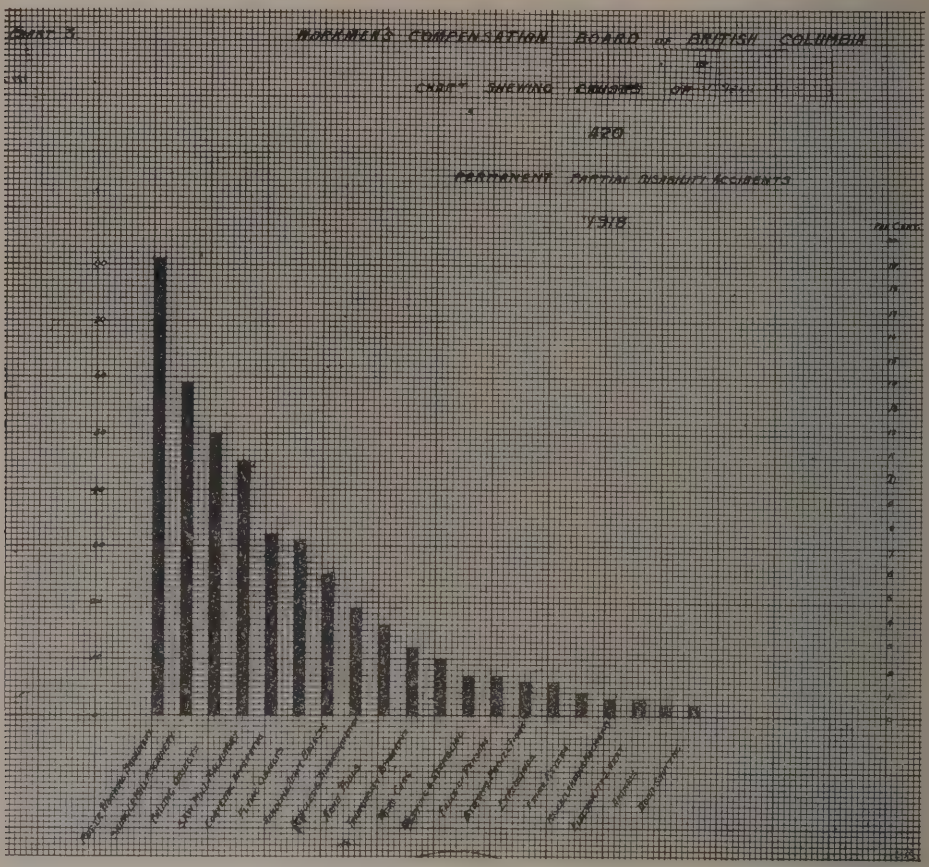


CHART X
WORKMEN'S COMPENSATION BOARD OF BRITISH COLUMBIA
CHART SHEWING CAUSES OF
TEMPORARY TOTAL DISABILITY ACCIDENTS
1918
500
10%
5%



CONCLUSION.

RE UNIFORM WORKMEN'S COMPENSATION LEGISLATION FOR WESTERN PROVINCES.

During the month of September the Government appointed the Chairman of the Board to meet the representatives of the Provinces of Manitoba and Alberta on the question of uniform workmen's compensation legislation for the Western Provinces.

With the Honourable T. H. Johnson, Attorney-General representing Manitoba, and Mr. J. T. Stirling, Chairman of the Alberta Board, representing Alberta, the conference met in the Board offices in Vancouver on September 30th, 1918, and was continued on October 1st and 5th.

A thorough discussion of the different Acts was had, and while the representatives gained a useful knowledge of the legislation of the other Provinces, it was found that to secure any uniformity would involve radical changes, in some cases in the duration of payment to the injured workmen or the dependents; in others, in the medical service; and again in the methods of carrying the Accident Fund. The British Columbia representative feeling that the only means of securing uniformity would be to "level up" the legislation of the other two Provinces to the standard of the British Columbia Act, while Mr. Johnson and Mr. Stirling would naturally desire that radical changes in their legislation should arise from local requirements, the results then were that no definite conclusions were arrived at. But as the interprovincial character of many industries, and also the movements of workmen from one Province to another, makes uniformity in this type of legislation desirable, it was decided to submit the matter to the recently formed Commission to secure uniformity of laws throughout the Dominion.

HEALTH INSURANCE.

The recent war has proved that military success depends on industrial efficiency. This efficiency is mainly the result of the mental and physical condition of the individual worker.

Many of the large plants of the Atlantic Coast, recognizing the influence of health and home conditions on the efficiency of the workman, have established health departments in charge of competent physicians to care for the requirements of the workman and his family. The fact that the tendency in this direction is rapidly extending, and in this age when competition is at its peak, is the best possible evidence that from a financial standpoint the service is justified.

Briefly summarizing, a workman is at his maximum of efficiency when in good health and when not depressed by fears arising from home conditions that he is unable to cope with. A value cannot be placed on this factor, yet it is safe to assume that under these circumstances errors of judgment that lead to waste in time and material and frequently injury to the workman himself are at a minimum.

One of the greatest items of waste in modern society is the time lost and the reduction in physical standard caused by disease that could either have been prevented or at least limited by efficient medical service. Another factor is the loss sustained by a family when its support is either withdrawn by death or a long siege of illness.

If our reasoning is correct, we are forced to the conclusion that the health of the workman and his family, as well as his ability to meet the financial requirements of the home, are matters of public concern.

Benefit societies have done and are doing good work in this direction, but the multiplicity of effort, the lack of uniformity, and the absence of compulsion restricts their usefulness to a narrow field. It would therefore seem that the problem can only be met by State control of medical service and payments in case of sickness or death similar to accident insurance.

Fortunately for those who take this view, the duty of the State in these matters has already been decided in England in favour of the workman. Several of the Eastern States are paying particular attention to this subject. We early realized the necessity of health insurance, and at every opportunity when addressing the different organizations endeavoured to direct public attention in its favour. It is, we believe, a matter for congratulation that the subject has already been brought to the notice of the Legislative Assembly of this Province.

Our interest in this question is particularly emphasized by the fact that our work brings us constantly in contact with these matters. For instance, during the first year's operation of the Act we repeatedly found cases where the workman did not obtain medical service, the invariable excuse being that he hoped to avoid the expense, or that he felt that he could not pay for it, wrongly believing that he would be responsible therefor.

In the closing months of the last year we have been compelled to reject a number of claims arising out of the influenza epidemic, in which mothers with small children made application for pensions. One case was particularly painful. When informed that we must reject her claim, the mother of eight small children asked us in desperation: "What am I to do?" We were unable to answer. She withdrew from the Board room accompanied by two of her frightened children clinging to her skirts, and one in her arms, to answer the question as best she could.

These experiences also compel us, at the risk of being censured for going outside of our sphere, to call attention to the enormous wastage of life, health, and happiness through failure or inability to obtain medical attention. An example of the latter was presented to us early in January last, when a widow with four children, having no other resources but her pension of $40 per month, inquired as to whether the Act permitted her medical attention for herself and family. In such a case medical services could only be paid for out of the funds which were much needed for food and clothing.

The full import of this situation does not present itself to those resident in the centres of population, and where medical charges are at a minimum. In the outlying sections of the Province, where mileage is added to the medical fee, the matter is much more serious. If we compute the costs of cases of delay in calling, or absence of medical attention, in loss of work, in lowered vitality, in the failure to secure early isolation in infectious diseases, and in premature deaths, we cannot avoid coming to the conclusion, from the humanitarian as well as the economic standpoint, that the time has now arrived when there should be State health insurance.

During the year, as in the previous years, the members of the Board as a body, in pairs or singly, addressed labour bodies, commercial organizations, Boards of Trade, Medical Associations, Hospital Associations and the Boards thereof, as well as fraternal organizations, explaining the Act's requirements and soliciting co-operation from them as well as the public. The members

of the Board have at all times held themselves in readiness to address any body that was interested in the Act's requirements, and to take up with that body or any individual members or parties interested in the work any question upon which they sought a better understanding.

An Information Bureau is maintained at the Board offices in the Board of Trade Building at Vancouver, so those desirous of obtaining information may do so, or if unable to appear in person a letter would receive immediate and courteous attention. Copies of the Act or the Board's report or any other of the Act's requirements may be received for the asking.

During the year many thousands of circulars have been sent out from the offices to the different branches of industry, the different employers, to the Medical Associations and members thereof, in an endeavour to clear up those misapprehensions that would appear to arise from time to time.

The Board desires to bear public testimony to the excellent, whole-hearted, and efficient service rendered by the various members of the staff in the energy and care of the work passing through their hands, as well as their courteous treatment of the public, on which, to a great extent, depends the success of the work.

Respectfully submitted.

E. S. H. WINN,
Chairman.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

ANNUAL REPORT

OF THE

MENTAL HOSPITALS

OF THE

PROVINCE OF BRITISH COLUMBIA

FOR THE YEAR 1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1919.

Recreation-ground, New Westminster

Mental Hospital, New Westminster

To His Honour Sir Frank Stillman Barnard, K.C.M.G.,

Lieutenant-Governor of the Province of British Columbia.

May it please Your Honour:

The undersigned respectfully submits herewith the Annual Report of the Medical Superintendent of the Mental Hospitals for the year 1918.

J. D. MacLEAN,

Provincial Secretary.

Provincial Secretary's Office, February, 1919.

Members of the Provincial Mental Hospitals and Colony Farm Staffs who have joined the Colours.

Lieut.-Col. C. E. Doherty, M.D. Captain D. D. Freeze, M.D.

Lieutenant R. Cullen.

Sergeant-major H. Banham. Sergeant-major E. Croft.

Sergeant J. O'Reilly. Sergeant D. Montgomery.

Corporal H. Hoult.

HONOUR ROLL.

✠

KILLED IN ACTION.

✠

S. McCOMBE,
Private, 104th Westminster Fusiliers.

J. McDONALD,
Trooper, British Columbia Horse.

L. BUNDY,
Private, 104th Westminster Fusiliers.

F. UPHAM,
Reservist, Somerset Light Infantry.

W. H. WILLIAMS,
Private, 104th Westminster Fusiliers.

A. MILNE,
Private, 62nd Battalion, C.E.F.

G. WICKHAM,
Private, 47th Battalion.

Private A. Talbot.
Private E. Orme.
Private W. D. Patchell.
Private T. Woodburn.
Private T. E. Morris.
Private D. Price.
Private D. Hughes.
Private W. McVie.
Private A. McLennan.
Private F. E. Frankum.
Private A. N. Campbell.
Private A. Hall.
Private A. M. Exley.
Private Benj. Jones.
Private W. Crystall.

Private J. Loban.
Private E. Dickie.
Private F. Upham.
Private J. McDonald.
Private S. McCombe.
Private W. H. Williams.
Private A. M. Miller.
Private L. Bundy.
Private G. Farrant.
Private W. Robertson.
Private W. Headridge.
Private C. Oxenbury.
Private G. B. McNaughton.
Private J. Davidson.
Private S. Wickham.

Private A. Milne.
Private H. A. Sparrow.
Private W. Ronald.
Private J. Robertson.
Private G. Davidson.
Private R. McKechnie.
Private H. Lonsdale.
Private H. W. Strong.
Private A. E. Smith.
Private J. Pollard.
Private E. Sands.
Private H. Bailey.
Seaman W. Mackie.
Private G. Wickham.

OFFICERS AND STAFF, MENTAL HOSPITALS.

Officers at New Westminster.

Clerical Staff:

C. E. Doherty, M.D., C.M., *Medical Superintendent.*
H. C. Steeves, M.D., C.M., *Assistant Medical Superintendent.*
T. W. McAllister, M.D., *Assistant Physician.*
C. H. Gooding, *Analyst.*

Clerical Staff:

Gowan S. Macgowan, *Bursar.* Thomas H. Cambridge, *Receiving Clerk.*
Lucy Sheppard, *Clinical Clerk and Stenographer.*

Chaplains:

Rev. R. Lennie, Church of England. Rev. Father Murphy, Roman Catholic.

Nursing Staff and Trade Instructors:

Maria Fillmore, *Matron.*
J. P. O'Reilly, *Steward.*
R. T. Hall, *Carpenter.*
J. Booth, *Gardener.*
W. F. Beggs, *Tailor.*
J. McMillan, *Shoemaker.*
F. Spooner, *Chief Attendant.*
W. F. Johnston, *Engineer.*
H. Bailey, *Farmer.*
C. Slater, *Painter.*
E. B. Jones, *Laundryman.*
H. Oliver, *Plumber.*

Officers of Essondale and Colony Farm.

Medical Staff:

C. E. Doherty, M.D., C.M., *Medical Superintendent.*
A. L. Crease, M.D., C.M., *Assistant Medical Superintendent and Pathologist.*
E. J. Ryan, M.D., C.M., *Assistant Physician.*

Clerical Staff, Head Office:

Gowan S. Macgowan, *Bursar.* C. Fletcher, *Chief Clerk.* M. H. McCabe, *Book-keeper.*
Floy Chase, *Clinical Clerk and Stenographer.* Gladys Oakley, *Business Stenographer.*

Chaplains:

Rev. C. Yates, Church of England. Rev. Father Marcucci, Roman Catholic.

Nursing Staff and Trades:

G. Mathewson, *Chief Attendant.*
J. B. Foster, *Chief Cook.*
A. A. Killen, *Painter and Decorator.*
E. Fitzgerald, *Mason and Builder.*
R. Gow, *Carpenter.*
J. Hargie, *Laundryman.*
J. L. Malcolm, *Chief Engineer.*
T. Mowbray, *Electrician.*
E. Huffnell, *Plumber.*
L. B. Stinchcombe, *Outside Overseer.*
S. F. Hambly, *Baker.*
W. J. Willows, *Barber.*

Colony Farm:

P. H. Moore, *Superintendent.* J. F. Simmonds, *Record Clerk.*

Driveway to Hospital, New Westminster.

REPORT OF MEDICAL SUPERINTENDENT

FOR THE YEAR ENDING DECEMBER 31ST, 1918.

The Honourable the Provincial Secretary,
Victoria, B.C.

SIR,—I have the honour to submit herewith the Forty-seventh Annual Report of the Public Hospitals for the Insane at New Westminster and Essondale, B.C. This report embraces a full account of the operations of these institutions for the year 1918, together with a summary of the requirements for the ensuing year, which I trust may receive the approval of your Department before the Estimates of the Provincial Legislature are framed.

It will be noticed that the accompanying statistical tables, covering the operations of the Hospitals during the year, differ in some details of form, although little in content, from those published in former years.

ADMISSIONS.

During the year 371 patients were admitted, a very large number when the admissions of a few years ago are considered. This phenomenally rapid increase has at times taxed to the utmost our accommodation. True, the taking-over of the modern building at Saanich as a hospital for our criminally insane will relieve the situation to some extent, and will permit of the proper segregation of this class of our insane for years to come. Still, the necessity for a modern hospital for the proper and scientific study and treatment of our acute cases still exists, and I would strongly advise the early consideration of the erection of such a building at Essondale for male cases; such a building to contain the best features of a modern psychopathic hospital.

The burden upon the taxpayer of caring for the constantly increasing numbers of insane has occasionally given rise to a division of sentiment when the question of appropriations for their care has been under discussion, but I can assure you that those members of the Legislature who oppose a liberal and enlightened policy do so under a mistaken idea of economy. It is astonishing that even among some of the members of the medical profession there are those who insist that active treatment by the more expensive hospital methods, hydrotherapy, and laboratories with expensive apparatus and equipment is of no avail, except to increase expense and make a show, and that formerly, in the time of the old strait-jacket, box-bed, and seclusion, patients recovered with none of these costly aids as frequently, or nearly as frequently, as with them. This is the attitude assumed by those who, it is hoped, constitute only a very small minority in this enlightened Province.

We are obliged, in candour, to concede that, notwithstanding the general adoption of hospital methods in the treatment of our insane, with the laboratory and various modern therapeutic measures, we have failed to establish as high a rate of recovery as we would like, but to some extent we have been successful, and we are determined, sir, with your assistance, to further adopt the methods of the general hospital, rather than that of the asylum, to simply feed, clothe, and comfortably shelter the insane, or, in other words, to simply render custodial care.

In further considering the matter of increased admissions, it may be said that, notwithstanding the existing laws regarding immigrants and immigration, which are supposed to prohibit the entrance into this country of the feeble-minded, insane, and those suffering with incurable diseases, a tremendous number of such are, in some way, continuously gaining admission, and the necessity for some method of more adequate supervision and intelligent inspection, not by laymen, but by medical men with the proper experience as phychiatrists, is yearly becoming more apparent.

Our existing Dominion legislation has now been in effect for some twelve years, and the question naturally arises as to the effect it has had on preventing the entrance of the insane and others of the proscribed classes which furnish such a burden on the various Provinces. This question can best be answered by stating the number or proportion of those cases resident in our public institutions. In our British Columbia institutions not quite 8 per cent. are British Columbia born, and not over 20 per cent. Canadian born. Surely these statistics are sufficient

to demonstrate conclusively that the burden imposed upon the Province in providing proper accommodation for insane, who properly belong to other countries, is of much importance to us as a Province.

Take the financial aspects of this undertaking, and I think it will surprise you, just as much as it did me, after I had commenced to figure out exactly what it meant. To arrive at any intelligent conclusion as to just what this might be, let us figure exactly. Take New York State, where the Comptroller has recently appraised their score of institutions in order to estimate exactly what *per capita* investment the State had in connection with their insane; he found this to be a *per capita* one of $1,000, or a total investment of $47,000,000. This represents the cost to the State in providing institutions and plants for the care and treatment of their insane.

In our Province we have a *per capita* investment of about $1,000, and if we would consider interest on the money invested, which would seem fair at 4 per cent., and estimate the amortization cost at 3 per cent., to cover general depreciation of buildings, equipment, etc., we have a total charge of 7 per cent. on the original investment. Our average *per capita* cost for maintenance during the past five years has been $200, while the cost of committal, transportation, etc., would amount to about $5 as a fair average.

The total *per capita* cost to the Province can therefore be summarized as follows:—

Interest on investment and equipment	$ 70 00
Maintenance	200 00
Other costs	5 00
Total *per capita* annual cost	275 00

Take our last year's admission of 375, and we find that 72 per cent., or 270, were foreign born; this 270, at a cost of $275 per head, would represent $74,250, the actual cost to which the Province was unnecessarily put. This, however, is only for one year, but we have found here (as has also been found in older institutions, where statistics extend over many years) that the average hospital-life of each patient is ten years; therefore those of foreign birth admitted to this Hospital last year alone will, before we are through with them, cost the Province $742,500.

I go into this matter in the above cold-mannered way in order to show you just how very important the matter of promiscuous immigration is to one Province, in only one branch of incapables, and to give you some idea of what a tremendous burden it will eventually become if allowed to go on. To emphasize this, I would call your attention to the fact that, in the United States, where promiscuous immigration went on for many years, the problem in New York State has assumed such astonishing proportions that last year it became necessary for that State to devote practically one-fifth of its entire revenue to care for an insane population which they estimate, if strict immigration laws had been enforced for the past twenty years, would not be 40 per cent. of what it is at the present time.

It would appear to me that this question should be one of the very first to be taken up by the newly formed Canadian National Committee for Mental Hygiene, and if the committee could secure effective results a great national good would be accomplished.

TREATMENT.

The time has now arrived in this Province when voluntary admission and the establishment of a psychopathic wing in connection with our largest general hospital should be established. It would appear that Vancouver should be the city and the Vancouver General Hospital the hospital. The establishment of such a psychopathic hospital with voluntary admission would immediately have the effect of making the public understand the fact that insanity is a disease requiring early and careful treatment, and would also undoubtedly, in a considerable percentage of cases, obviate the necessity for legal committal.

If a proper outdoor service was also established in connection with this psychopathic department, great assistance to the Province could be given. If such an outdoor service was in charge of qualified men, it might be hoped that they would be able to pick out many of those types liable to develop psychoses, and to protect them from those classes of stress which they are least able to withstand. The neurotic child would be recognized and could be safeguarded, especially throughout school-life and the period of puberty and adolescence. In my mind there is no doubt that competent advice would be sought by parents as to the best methods to be employed in the rearing of their children. Until then it might be said we are largely helpless in the matter of prevention.

Front entrance to Hospital.

In the treatment of the psychoses the general principles of therapeutics are, of course, applicable, as in other departments of medicine, and have been followed by the medical staffs of our hospitals. To provide good treatment and obtain good results an intelligent, well-trained, and conscientious staff is necessary. The happiness and welfare of the patients while they are in our hospitals depend greatly on the character and conduct of the nurses, male and female; upon their efficiency depends, hourly and momentarily, the safety of the patients; while upon their humanity and conscientiousness depend, continuously, the comfort, happiness, and well-being of the afflicted assigned to them.

I am glad that you, as Provincial Secretary, have fully realized the manifest and overwhelming importance of this question, and as a result have never placed in any way the slightest obstacle against the instant dismissal of employees for brutality and insubordination. Without strict discipline and full authority to discharge nurses and attendants for sufficient reason, the best superintendent that ever breathed is powerless to effect any improvement in his patients or in the hospital over which he is the head.

I am pleased to be able to report that the pathological department is again in full operation, affording full facilities for scientific work directly connected with our ward cases, and essentially as an aid to diagnosis, and it is encouraging to realize that it is achieving its purpose in a manner which is creditable to our institution.

Occupational Therapy.

The necessity and wisdom of liberally providing means of diversion for the insane is so generally admitted that the question is scarcely, if at all, in the field of controversy. In observance of this well-recognized fact we have given our patients every form of amusement, employment, and diversion possible under existing conditions. Encouragement has been given them to work in the shops, in the gardens, on lawns, and in various departments of the farm. Weekly dances, concerts, and picture-shows have been given throughout the winter season, while tennis, baseball, and football have been a source of pleasure and helpful comfort to a considerable number during the summer months.

I would like here to give expression to our experience in agricultural pursuits as an occupational therapy with our insane. We have found that work, and especially work in the open air and in open and healthy surroundings, is of the utmost value for mental patients. Being a factor in the production of health and happiness, it also becomes a means of cure. I maintain that where work for patients is carefully organized the mortality-rate is decreased, mechanical restraint is unnecessary, and recoveries are more frequent; the spirits of the patients are brightened, the labour of those who attend them is ameliorated, and the mission of the Province, which thus provides not only for the custody but also for the recovery of its patients, is ennobled. I therefore claim that our large farming operations are not only the best therapeutic help, but also an economical and productive one, and should continue to receive every encouragement and assistance that our Government can afford to give it.

In providing entertainments and amusements for the patients, the same emphasis as in occupational training is placed upon the idea that its primary purpose is to aid in the patients' mental restoration. Unless a cheerful, helpful atmosphere pervades an institution, the best results are unattainable, no matter what other facilities or what professional skill may be available. The mentally diseased are out of harmony with their environment, and environmental conditions in a hospital should be such as to render simple readjustments easy and inviting and essential to any process of improvement.

Expenditure.

The effect of war conditions is graphically shown in the summary contained in Tables E and F. Despite every effort to eliminate every item of expense not imperatively necessary to maintain a proper standard of care, the cost of maintenance has increased slightly over the previous year. During the year the price of practically all supplies purchased by the Hospitals advanced approximately 35 per cent., while during the latter part of the year it was not always so much a matter of price in making essential purchases as of finding dealers able to furnish supplies in the quantities required to meet the Hospitals' needs. Under such circumstances I think the net *per capita* cost of maintenance—namely, 56 cents per diem at New Westminster and 63 cents per diem at Essondale—is a very creditable one, and in this connection much credit is due our Bursar, Mr. Macgowan, and also our Chief Stewards, Mr. Pumphrey and Mr. O'Reilly.

TABLE A.

Showing the Average Number of Patients in Residence each Year, the Total Amounts spent for Maintenance, and the *Per Capita* Cost.

Year.	Average Number in Residence.	Maintenance Expenditure.	*Per Capita* Cost.
1872 (81 days)	16.57	$ 2,265 25	$616 00
1873	16.07	7,841 94	487 98
1874	16.76	8,232 41	491 20
1875	27.42	9,892 38	360 77
1876	36.41	12,558 18	344 91
1877	34.61	12,917 17	373 26
1878	36.52	13,985 05	382 93
1879	38.17	10,253 72	268 63
1880	45.42	10,552 18	232 32
1881	47.18	10,691 76	226 62
1882	47.86	11,343 65	237 02
1883	48.73	11,829 11	242 75
1884	48.70	11,843 94	243 20
1885	54.67	15,555 87	284 54
1886	59.11	15,334 43	259 42
1887	73.55	15,945 22	216 70
1888	79.43	16,261 06	204 72
1889	71.30	15,657 79	219 60
1890	78.78	17,577 80	223 13
1891	119.87	21,757 03	181 50
1892	125.24	23,518 37	187 80
1893	133 92	25,904 98	193 36
1894	148.64	26,495 83	178 25
1895	162.97	31,587 89	193 83
1896	171.43	32,001 40	186 67
1897	188.91	36,224 76	191 75
1898	216.53	46,420 25	214 38
1899	226.44	54,917 45	242 52
1900	243.24	59,349 20	244 00
1901	269.56	55,406 08	205 54
1902	296.62	55,345 65	186 59
1903	332.23	59,353 57	178 65
1904	351.55	66,052 76	187 89
1905	340.90	63,342 07	185 80
1906	374.57	66,596 69	177 79
1907	419.24	74,874 64	178 59
1908	490.80	90,269 49	183 92
1909	526.85	96,586 32	183 32
1910	563.33	103,900 44	184 43
1911	641.02	126,782 50	197 78
1912	736.72	130,924 06	177 71
1913, M.H., New Westminster	550.54	119,663 71	217 36
1913, M.H., Essondale (9 months)	384.07	71,079 84	184 76
1914, M.H., New Westminster	487.24	125,981 45	258 56
1914, M.H., Essondale	489.07	131,420 44	268 36
1915, M.H., New Westminster	515.74	123,021 70	238 53
1915, M.H., Essondale	560.56	123,878 43	220 99
1916, M.H., New Westminster	524.17	116,052 21	221 40
1916, M.H., Essondale	633.13	155,698 37	245 91
1917, M.H., New Westminster	535.66	124,124 68	231 72
1917, M.H., Essondale	716.35	166,231 51	232 05
1918, M.H., New Westminster	585 38	156,574 85	267 47
1918, M.H., Essondale	752.78	222,097 37	295 03

TABLE B.

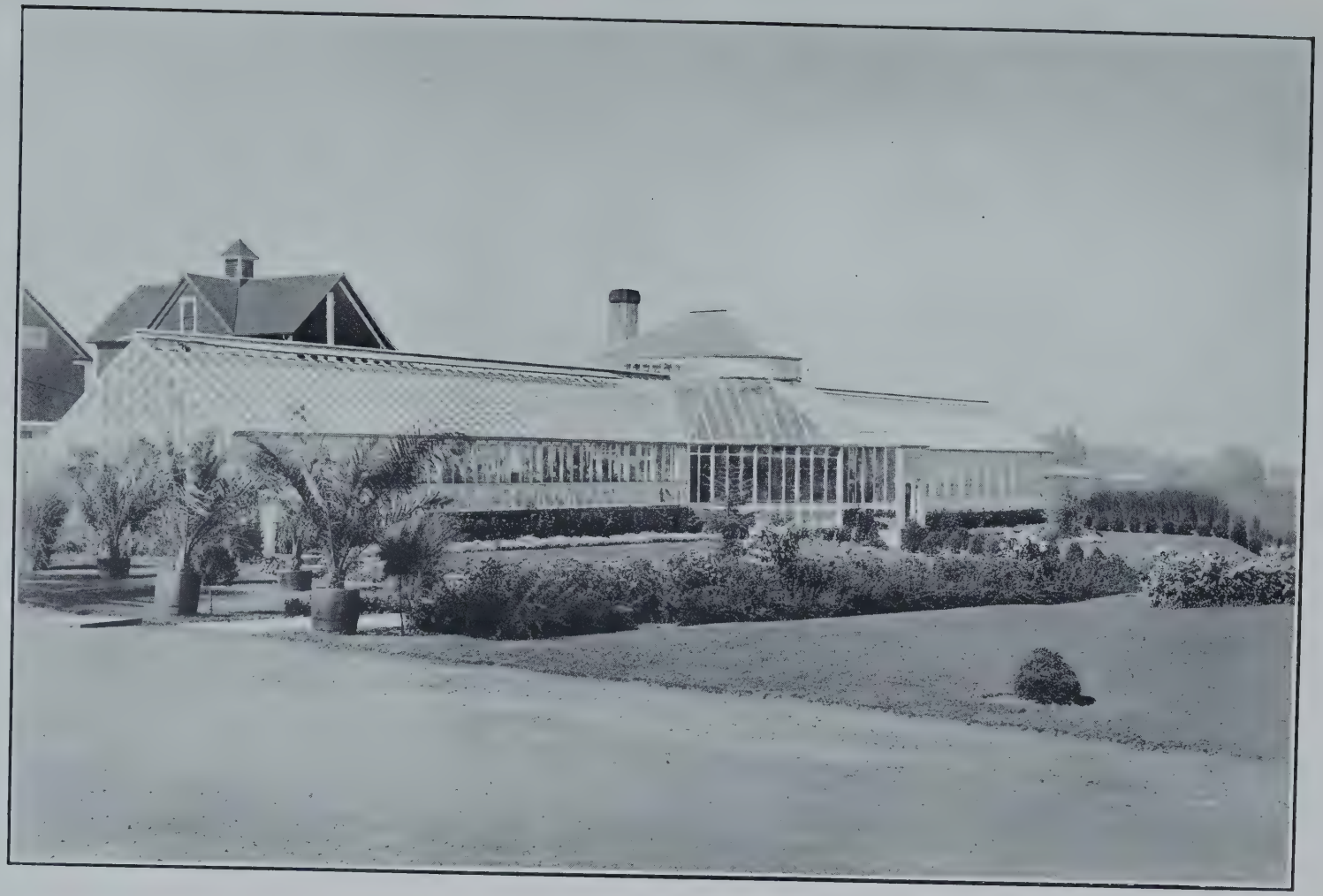
Showing Analysis of the *Per Capita* Cost.

Year.	Salaries.	Provisions.	Clothing.	Fuel and Light.	Furniture.	Medicines.	Miscellaneous.	Total.
1872.....	$279 38	$184 03	$55 81	$22 44	$15 55	$10 18	$49 30	$616 69
1873.....	221 48	166 81	14 55	23 65	21 59	7 74	32 16	487 98
1874.....	231 10	152 10	22 07	23 98	28 36	7 78	25 81	491 20
1875.....	153 82	113 40	13 98	16 88	25 45	6 73	30 51	360 77
1876.....	143 34	114 45	18 68	22 75	17 90	2 86	24 93	344 91
1877.....	177 15	126 75	20 69	4 66	20 75	3 74	19 52	373 26
1878.....	176 16	124 23	30 43	13 94	7 20	9 16	21 82	382 93
1879.....	134 27	95 10	3 25	15 91	6 39	6 31	7 40	268 63
1880.....	111 84	87 71	5 74	14 06	6 00	3 63	3 34	332 32
1881.....	112 44	81 14	6 86	12 73	5 55	2 56	5 34	226 62
1882.....	121 51	84 52	7 05	12 30	4 54	3 49	3 61	237 02
1883.....	123 81	92 56	6 03	11 04	4 26	2 24	2 82	242 75
1884.....	124 02	90 64	7 03	12 43	4 14	2 77	2 18	243 20
1885.....	169 05	84 33	6 33	15 05	3 90	2 93	2 95	284 54
1886.....	159 03	69 35	5 49	16 20	3 72	1 59	4 04	259 42
1887.....	127 80	59 10	5 88	15 38	3 88	93	3 81	216 78
1888.....	118 34	60 47	4 41	13 90	3 11	2 09	2 40	204 72
1889.....	131 76	59 11	7 20	12 93	4 13	2 07	2 46	219 60
1890.....	121 54	62 77	9 02	17 31	4 00	1 29	7 19	223 12
1891.....	88 35	54 79	3 83	20 43	3 40	1 89	8 81	181 50
1892.....	94 25	56 74	4 69	20 53	3 35	1 80	6 42	187 80
1893.....	95 50	53 55	5 43	22 60	3 39	2 69	10 20	193 36
1894.....	87 76	57 07	5 25	18 83	2 98	1 43	4 93	178 25
1895.....	90 83	61 15	9 90	20 41	2 51	3 10	5 93	193 83
1896.....	89 13	55 93	6 30	20 29	2 56	3 63	8 83	186 67
1897.....	89 09	58 18	8 36	19 11	2 95	3 86	10 20	191 75
1898.....	94 68	69 43	9 94	21 82	2 76	5 12	10 62	214 37
1899.....	113 31	72 91	8 31	33 96	2 50	2 73	8 80	242 52
1900.....	116 04	72 62	9 06	32 10	2 15	1 71	10 32	244 00
1901.....	99 16	66 65	10 12	18 52	3 25	1 07	6 77	205 54
1902.....	87 47	61 13	7 95	15 25	4 13	1 20	9 46	186 59
1903.....	82 36	57 86	8 58	14 77	3 24	1 91	9 93	178 65
1904.....	87 43	60 01	6 85	17 84	4 48	2 10	9 18	187 89
1905.....	92 17	54 09	5 99	17 93	3 83	2 03	9 76	185 80
1906.....	88 76	53 15	5 16	15 92	3 57	1 21	10 02	177 79
1907.....	89 18	48 47	5 81	19 82	3 02	1 57	10 72	178 59
1908.....	90 93	49 17	6 61	17 63	4 56	1 79	13 23	183 92
1909.....	94 27	53 41	8 16	13 02	2 78	84	10 84	183 32
1910.....	95 97	48 43	7 87	21 32	2 02	1 15	7 67	184 43
1911.....	97 44	58 08	9 39	18 84	1 12	1 87	11 04	197 78
1912.....	78 40	56 37	10 09	19 36	1 79	1 50	10 20	177 71
1913, M.H., New West.	102 37	54 07	9 43	25 27	4 74	3 21	18 27	217 36
1913, M.H., Essondale.	93 56	49 90	5 50	25 13	55	1 02	14 10	184 76
1914, M.H., New West.	115 72	68 15	2 99	24 13	69	2 64	44 24	258 56
1914, M.H., Essondale.	113 06	81 42	15 49	28 93	4 14	1 19	24 13	268 36
1915, M.H., New West.	110 94	64 32	7 57	20 30	....	1 88	33 52	238 53
1915, M.H., Essondale.	95 25	62 84	9 44	24 87	1 14	56	26 89	220 99
1916, M.H., New West.	105 89	74 96	2 58	18 52	....	1 45	18 00	221 40
1916, M.H., Essondale.	89 26	75 18	17 76	26 96	4 98	42	31 35	245 91
1917, M.H., New West.	103 41	72 20	10 52	18 29	....	2 38	24 92	231 72
1917, M.H., Essondale.	83 57	79 98	18 92	23 39	4 77	81	20 61	232 05

TABLE B 1.

Showing Analysis of the Gross *Per Capita* Cost.

Year.	Salaries.	Office Supplies.	Travelling Expenses.	Fuel, Water, Light.	Repairs and Renewals.	Furniture and Fixtures, Bedding, etc.	Provisions.	Clothing, Boots, and Slippers.	Medical and Surgical Supplies.	Examination, Committal, and Transportation.	Incidentals and Unforeseen.	Total Gross.
1918, New Westminster	$102.815	$2.133	$0.097	$27.186	$3.706	$9.547	$ 99.989	$ 7 103	$2.102	$4.103	$8.694	$267.47
1918, Essondale.....	96.777	3.000	0.482	33.378	5.849	8.438	118.888	17.235	1.663	0.060	9.266	295.03



Greenhouse, New Westminster.

Table C.

Showing the Total Expenditure of the Mental Hospital annually since its Inception, analysed under its Various Headings.

Year.	Salaries.	Provisions.	Clothing.	Fuel and Light.	Furniture (estimat'd)	Medicines, etc.	Miscellaneous.	Total of Current Expenditure.	Expenditure on Capital Account.			
									New Furniture.	Library.	Surgical Instruments.	Lands and Works.
1872-87	$91,899 70	$59,567 24	$6,482 84	$9,317 03	$5,331 52	$2,307 04	$6,131 55	$181,042 26	$2,600 00	.....	.....	$917 26
1888	9,399 96	4,803 57	350 17	1,103 86	247 24	165 60	190 66	16,261 06	.....	.....	$ 32 00	224 34
1889	9,390 62	4,214 19	513 73	922 00	293 69	147 76	175 80	15,657 79	.....	.....	.....	625 56
1890	9,575 13	4,945 57	710 64	1,363 52	315 28	101 90	565 96	17,577 80	2,800 00	.....	.....	2,181 91
1891	10,590 28	6,568 27	459 58	2,449 09	406 84	226 31	1,056 66	21,757 03	900 00	.....	.....	1,001 86
1892	11,803 83	7,106 64	587 48	2,571 26	418 82	226 19	804 15	23,518 37	.....	.....	.....	433 99
1893	12,790 28	7,172 53	729 38	3,029 00	452 55	362 08	1,369 16	25,904 98	650 00	$ 19 00	10 75	718 49
1894	13,044 16	8,492 53	771 05	2,799 87	442 69	212 86	732 67	26,495 83	200 00	.....	.....	170 32
1895	14,802 47	9,963 54	1,611 96	3,324 54	419 01	502 90	963 47	31,587 89	1,800 00	.....	.....	1,915 28
1896	15,280 62	9,588 22	1,079 85	3,479 46	439 36	623 24	1,511 05	32,001 40	800 00	.....	148 01	1,126 74
1897	16,829 76	10,991 05	1,579 08	3,610 03	557 97	728 73	1,928 14	36,224 76	1,200 00	5 15	19 00	848 38
1898	20,502 31	15,032 71	2,153 11	4,725 96	598 05	1,109 66	2,298 45	46,420 25	2,700 00	.....	6 39	5,320 30
1899	25,658 15	16,511 05	1,882 13	7,690 35	566 86	617 27	1,991 64	54,917 45	1,300 00	8 60	.....	2,518 80
1900	28,224 96	17,665 60	2,203 97	7,807 15	521 96	415 10	2,510 46	59,349 20	2,400 00	29 10	11 89	1,806 10
1901	26,729 01	17,967 31	2,727 11	4,993 67	875 30	288 40	1,823 28	55,406 08	1,840 53	25 10	14 65	5,175 20
1902	25,945 89	18,132 13	2,359 90	4,525 45	1,221 87	354 38	2,806 03	55,345 65	1,157 47	104 20	19 20	5,561 42
1903	27,362 37	19,222 50	2,850 19	4,906 22	1,077 73	634 16	3,300 40	59,353 57	1,723 70	111 48	9 00	8,426 70
1904	30,735 95	21,096 19	2,409 34	6,271 55	1,574 84	738 85	3,226 04	66,052 76	1,463 48	132 53	16 95	4,593 88
1905	31,421 45	18,437 99	2,043 45	6,110 76	1,306 22	693 49	3,328 71	63,342 07	1,711 84	91 47	69 15	3,981 72
1906	33,243 80	19,908 19	1,934 15	5,965 32	1,337 80	453 41	3,754 02	66,596 69	1,365 76	100 30	114 16	5,564 03
1907	37,394 21	20,326 99	2,439 64	8,314 36	1,265 63	655 66	4,498 15	74,874 64	4,352 22	150 88	144 63	9,410 66
1908	44,626 20	24,132 49	3,244 77	8,652 81	2,239 68	877 40	6,496 14	90,269 49	5,646 86	127 50	91 01	10,775 00
1909	49,665 85	28,142 65	4,298 91	6,856 11	1,465 79	441 59	5,715 42	96,586 32	2,598 95	89 58	21 30	16,615 10
1910	54,049 80	27,278 49	4,437 29	12,014 30	1,141 57	653 09	4,325 90	103,900 44	4,043 58	139 76	9 50	12,465 08
1911	62,453 00	37,229 56	6,020 57	12,079 62	722 10	1,200 92	7,076 73	126,782 50	11,169 78	154 75	43 82	14,429 02
1912	57,755 68	41,531 72	7,433 68	14,266 18	1,318 66	1,105 82	7,512 32	130,924 06	4,477 21	187 46	301 15	13,144 06
1913, New Westminster.	56,359 76	29,767 27	5,191 33	13,909 72	2,608 03	1,767 42	10,060 18	119,663 71	4,697 77	131 93	69 13	17,701 01
1913, Essondale. (9 mos.)	35,993 98	17,271 35	2,117 73	9,669 99	208 76	395 80	5,422 23	71,079 84	46,680 54	212 79	.....	14,904 63
1914, New Westminster.	56,381 62	33,204 11	1,455 28	11,758 11	338 03	1,286 68	21,557 62	125,981 45	.....	4,417 50	.....	10,117 16
1914, Essondale	55,364 40	39,873 66	7,585 71	14,168 66	2,026 29	584 23	11,817 49	131,420 44	1,087 31	.....	.....	4,236 37
1915, Essondale	53,392 50	35,225 51	5,287 03	13,942 39	639 67	316 87	15,074 46	123,878 43	841 31	.....	.....	4,628 99
1915, New Westminster.	57,217 21	33,174 90	3,902 49	10,469 03	.....	969 58	17,288 49	123,021 70	1,044 11	.....	.....	5,910 38
1916, New Westminster.	55,501 35	39,294 07	1,349 48	9,696 04	.....	777 94	9,433 33	116,052 21	1,395 09	.....	.....	8,623 88
1916, Essondale	56,515 64	47,601 27	11,242 29	17,066 96	3,154 13	268 96	19,849 12	155,698 37	2,418 80	.....	.....	14,402 82
1917, New Westminster.	55,393 19	38,674 92	5,639 40	9,795 36	.....	1,275 54	13,346 27	124,124 68	1,538 13	.....	.....	3,455 96
1917, Essondale	59,862 30	57,294 25	13,555 03	16,759 02	3,415 42	578 58	14,766 91	166,231 51	1,611 63	.....	.....	10,515 80

TABLE C 1.

Showing Gross Expenditure in Profit and Loss Accounts for Year analysed under its Various Headings.

Year.	Salaries.	Office Supplies and Postage.	Travelling Expenses.	Fuel, Water, Light, and Power.	Repairs and Renewals.	Furniture and Fixtures, Bedding, etc.	Provisions.	Clothing, Boots, and Slippers.	Medical and Surgical Supplies.	Examination, Committal, and Transportation.	Incidentals and Unforeseen.	Total Gross.
1918, New Westminster	$60,185 88	$1,248 42	$ 57 32	$15,913 89	$2,169 74	$5,588 44	$58,531 74	$ 4,157 86	$1,230 61	$2,401 62	$5,089 33	$156,574 85
1918, Essondale..	72,853 08	2,258 13	363 14	25,126 54	4,403 10	6,351 27	89,496 23	12,974 41	1,252 08	44 75	6,975 64	222,097 37

TABLE D.

Summary Statement showing the Gross and Net *Per Capita* Cost of Insane Patients to the Province in both Institutions.

Mental Hospital, New Westminster—			
Total maintenance vouchers (12 months)		$158,436 18	
Colony Farm Produce Account		14,431 99	
Essondale Hospital Account for ice, wood, etc.		1,582 67	
Jan. 1, 1918 Inventory, provisions		965 50	
„ „ „ furniture and fixtures		2,486 26	
„ „ „ clothing, woollens, etc.		1,537 90	
Total		$179,440 50	
Less Tailor Account for Essondale, clothing	$5,124 50		
„ boots and slippers, Essondale	644 00		
„ Colony Farm Account, *re* hogman	1,104 00		
„ „ „ *re* hog-feed	5,033 95		
„ „ „ patients' labour (contra)	1,440 00		
„ Dec. 31, 1918. Inventory, coal in bunkers	3,159 80		
„ „ „ „ furniture and fixtures	2,314 51		
„ „ „ „ provisions	368 49		
„ „ „ „ engineer's material	2,951 88		
„ „ „ „ clothing and woollens	2,157 77		
„ „ „ „ sundries	6 75		
		24,305 65	
Total City Institution			$155,134 85
Mental Hospital, Essondale—			
Total maintenance vouchers (12 months)		$196,601 38	
Colony Farm Produce Account		38,233 49	
City Institution Account, tailor's clothing		5,124 50	
„ „ shoes and slippers		644 00	
Jan. 1, 1918. Inventory, coal and wood		1,917 50	
„ „ „ furniture and bedding		4,654 34	
„ „ „ provisions		2,135 55	
„ „ „ clothing		4,260 45	
„ „ „ miscellaneous		173 07	
Total		$253,744 28	
Less supplies to City Institutions (*see* contra)	$ 1,582 67		
„ Colony Farm Account, board of employees	7,708 00		
„ „ „ auto-truck services	102 00		
„ „ „ feed, fuel, uniforms, etc.	1,899 81		
„ „ „ patients' labour, farm garden and nursery	14,900 00		
„ Dec. 31, 1918. Inventory, coal and wood	2,521 66		
„ „ „ „ furniture and bedding	5,345 89		
„ „ „ „ provisions	1,868 90		
„ „ „ „ clothing and woollens	8,140 27		
„ „ „ „ engineer's supplies	2,477 71		
		46,546 91	
Total Essondale Institution			207,197 37
Total expenses both institutions (12 months)			$362,332 22
Less collections remitted to Treasury—			
Mental Hospital, New Westminster	$ 35,169 86		
„ „ Essondale	32,100 14		
			67,270 00
Total net charge of both institutions			295,062 22

Showing a net *per capita* cost of $220.50 per year, or 60 cents per day.

TABLE E.

Expense and Revenue Statement of the New Westminster Hospital for Year ending December 31st, 1918.

Operating Expense Accounts.

Operating expenditure by vouchers—		
Salaries—		
Civil Service staff	$ 7,413 32	
Staff and employees	53,876 56	
		$ 61,289 88
Office supplies, etc.—		
Books, journals, stationery, postage	$ 699 00	
Telephone and telegraph	549 42	
		1,248 42
Travelling expenses		57 32
Fuel, water, light, and power—		
Fuel	$13,904 44	
Water	2,456 48	
Light and power	2,550 77	
		18,911 69
Maintenance and repairs to buildings, etc.—		
Repairs and renewals	$ 3,818 78	
Cleaning and janitor supplies	1,302 84	
		5,121 62
Furniture and fixtures, etc.—		
Bedding	$ 2,147 23	
Furniture and fixtures	1,192 73	
Miscellaneous	1,309 23	
		4,649 19
Provisions—		
Groceries	$29,257 21	
Meats	12,201 00	
Fish	2,378 46	
		43,836 67
Clothing, boots, slippers, etc—		
Clothing	$ 8,808 45	
Boots and slippers	1,737 78	
		10,546 23
Medical and surgical supplies	$ 863 29	
Medicines and drugs	367 32	
		1,230 61
Examinations, committals, and transportation—		
Examinations	$ 494 00	
Committals	23 00	
Transportation	1,884 62	
		2,401 62
Incidentals and unforeseen—		
Amusements	$ 193 15	
Gratuities	16 65	
Funerals	252 00	
Auto-tires, tubes, repairs, and parts	21 50	
Gasolene and oil	870 13	
Tools and implements	88 65	
Freight and cartage	12 01	
Miscellaneous (including hog-feed)	7,688 84	
		9,142 93
Total expenditure for 12 months by voucher		$158,436 18
Institution Trading Accounts—		
Colony Farm supplies—		
Dairy supplies	$ 5,833 25	
Vegetables, fruit, and honey	3,249 73	
Beef, pork, mutton, fowl	4,361 91	
Horse-labour, etc.	987 10	
		14,431 99
Essondale Hospital—		
Wood, ice, blankets, etc.		1,582 67
		$174,450 84

Scenes from Farm and Nursery.

TABLE E—*Concluded.*

Summary of Profit and Loss Accounts.

		Yearly *Per Capita* Cost.
Salaries	$ 60,185 88	$102.815
Expenses—		
Office supplies, etc.	1,248 42	2.133
Travelling expenses	57 32	.097
Fuel, water, light, and power	15,913 89	27.186
Maintenance and repairs to buildings	2,169 74	3.706
Furniture, fixtures, bedding, etc.	5,588 44	9.547
Provisions	58,531 74	99 989
Clothing, boots, slippers, etc.	4,157 86	7.103
Medical and surgical supplies	1,230 61	2.102
Examinations, committals, transportation	2,401 62	4.103
Incidentals and unforeseen, etc.	5,089 33	8.694
Total gross expenditure	$156,574 85	$267.475
Less patients' labour (contra against market price, Farm Account)	1,440 00	2,459
	$155,134 85	$265.016
„ receipts of revenue (maintenance)	35,169 86	60.080
Net cost to Government for maintenance of patients	$119,964 99	$204.936

Remarks.

Total patients in residence, New Westminster, December 31st, 1918, 596.
Daily average population, New Westminster, 585.38.
Gross maintenance *per capita* cost per year, $267.47.
Gross maintenance *per capita* cost per day, 73.28 cents.
Net maintenance *per capita* cost per year, $204.94.
Net maintenance *per capita* cost per day, 56.14 cents.

TABLE F.

Expense and Revenue Statement of the Essondale Hospital for the Year ending December 31st, 1918.

Operating Expense Accounts.

Operating expenditure by vouchers—		
Salaries—		
Civil Service staff	$10,117 88	
Staff and employees	62,734 20	
		$ 72,852 08
Office supplies, etc.—		
Books, journals, stationery, postage	$ 1,217 86	
Telephone and telegraph	1,040 27	
		2,258 13
Travelling expenses		363 14
Fuel, water, light, and power—		
Fuel	$18,700 05	
Water	4,189 80	
Light and power	3,928 37	
		26,818 22
Maintenance and repairs to buildings, etc.—		
Repairs and renewals	$ 4,915 97	
Cleaning and janitor supplies	1,964 84	
		6,880 81
Furniture and fixtures—		
Bedding	$ 4,080 82	
Furniture and fixtures	3,648 50	
Miscellaneous	81 00	
		7,810 32
Provisions—		
Groceries	$42,328 31	
Meats	15,813 58	
Fish	3,380 65	
		61,522 54
Carried forward		$178,505 24

TABLE F—*Continued.*

Brought forward		$178,505 24
Clothing, boots, and shoes—		
Clothing	$10,155 53	
Boots and shoes	1,194 20	
		11,349 73
Medical and surgical supplies—		
Medicines and drugs	$ 698 06	
Instruments and surgical supplies	554 02	
		1,252 08
Examinations, committals, and transportation—		
Examinations	$ 40 00	
Committals	.....	
Transportation	4 75	
		44 75
Incidentals and unforeseen—		
Amusements	$ 250 30	
Gratuities	75 50	
Funerals	697 00	
Auto tires, tubes, repairs, and parts	1,330 10	
Gasolene and oil	930 54	
Tools and implements	205 76	
Freight and cartage	98 18	
Miscellaneous	1,862 20	
		5,449 58
Total expenditure for 12 months by voucher		$196,601 38
Institution Trading Accounts—		
Colony Farm supplies—		
Dairy supplies	$13,731 40	
Beef, pork, mutton, etc.	2,468 30	
Horse-labour, etc.	2,459 20	
Miscellaneous	9 00	
		18,667 90
Gardens and nursery—		
Vegetables and garden-truck, fruit, honey, and flowers	.....	10,667 51
Piggery and Poultry Department—		
Pork	$ 5,789 61	
Eggs and fowl	3,108 47	
		8,898 08
Hospitals and Industrial Departments—		
Tailor-shop—		
Uniforms	$ 3,352 00	
Patients' clothing	1,772 50	
		5,124 50
Shoemaker-shop—Boots, shoes, and slippers	.....	644 00
		$240,603 37

Summary of Profit and Loss Accounts.

		Yearly *Per Capita* Cost.
Salaries	$ 72,853 08	$ 96.777
Expenses—		
Office supplies, etc	2,258 13	3.000
Travelling expenses	363 14	.482
Fuel, water, light, and power	25,126 54	33.378
Maintenance and repairs of buildings	4,403 10	5.849
Furniture and fixtures	6,351 27	8.438
Provisions	89,496 23	118.888
Clothing, etc.	12,974 41	17.235
Medical and surgical supplies, etc.	1,252 08	1.663
Examinations, committals, transportation	44 75	.060
Incidentals and unforeseen	6,975 64	9.266
Total gross expenditure	$222,097 37	$295.036
Less patients' labour (contra against market price, Farm Ac.)	14,900 00	19,792
	$207,197 37	$275 244
„ receipts of revenue (Maintenance)	32,100 14	42.635
Net cost to Government for maintenance of patients	$175,097 23	$232.609

TABLE F—*Concluded.*

Capital Expenditure.

Additions and improvement of buildings	$7,939 60
Grading and improvements of grounds	1,501 13
New furniture and fixtures	348 34
Total capital expenditure	$9,789 07

Remarks.

Total patients in residence, December 31st, 1918, 751.
Daily average population for year, 752.78.
Gross maintenance *per capita* cost per year, $295.03.
Gross maintenance *per capita* cost per day, 80.80 cents.
Net maintenance *per capita* cost per year, $232.609.
Net maintenance *per capita* cost per day, 63 cents.

REVENUE.

You will note that the revenue of the hospital shows considerable increase over any previous years. Close attention was given this matter, but I feel sure that we have in no instance worked a hardship on relatives of patients where leniency should have been shown.

The following table will show clearly the yearly collections at this office since the time of the institution's inception, and is worthy of your notice:—

1873	$1,440 99	1890	$ 599 24	1907	$20,753 35
1874	680 00	1891	761 15	1908	25,807 83
1875	1,342 60	1892	2,418 43	1909	25,845 65
1876	730 31	1893	1,585 40	1910	26,137 38
1877	799 91	1894	2,709 53	1911	30,100 20
1878	479 42	1895	4,409 23	1912	35,151 97
1879	867 38	1896	3,741 71	1913	40,756 56
1880	1,433 04	1897	3,816 80	1914	42,731 83
1881	614 99	1898	4,003 79	1915, New West.	18,046 21
1882	505 18	1899	4,769 04	1915, Essondale.	16,329 72
1883	298 24	1900	6,893 33	1916, New West.	18,135 91
1884	98 35	1901	12,800 76	1916, Essondale.	21,889 74
1885	.....	1902	10,926 23	1917, New West.	21,435 93
1886	50 00	1903	13,639 64	1917, Essondale.	25,350 09
1887	720 59	1904	15,004 22	1918, New West.	35,169 86
1888	750 00	1905	16,613 18	1918, Essondale.	32,100 14
1889	220 00	1906	19,058 42		

REQUIREMENTS.

The decision to take over the modern building at Saanich as a hospital for the criminally insane will permit us ready facility to overcome a long-felt want—namely, an opportunity of segregating in proper quarters this class of our insane; and, while the building this year of properly constructed hutments for our tubercular cases has also been a move in the right direction, there still remain two features calling for early consideration and action by the Government, namely:—

(1.) The urgent necessity for a modern hospital building at Essondale for the reception, proper examination, and scientific care and treatment of acute cases; such building should have accommodation for 200 cases and should contain the best features of a modern psychopathic hospital.

(2.) The second requirement is the proper provision for the more marked cases of the feeble-minded of the Province. The problem of the feeble-minded is one that is going to be with us for a long, long time, unless we do something to correct it; any Provincial plan for the care of the feeble-minded must relate itself definitely to the public-school system; under our compulsory-education law every child should come to the attention of the school authorities, and if there was a proper mental examination of the pupil the school record would eventually constitute a complete registration of the feeble-minded. It is surely as important, or even much more important, to train, properly, subnormal as normal children. In the more marked cases this should be done in special institutions, and I would advise early consideration of the erection of a group of buildings for this purpose.

Before closing this report I not only wish to thank personally, but to commend to your favourable consideration, the Assistant Medical Superintendents, Dr. Steeves, of the New West-

minster Institution, and Dr. Crease, of the Essondale Institution, and also the other Medical Officers, who, without exception, have laboured diligently and conscientiously to promote the administration of the Hospital throughout the year; the efficiency and untiring zeal at all times rendered by these officers have made my duties indeed very light. Your attention is also called to Dr. F. P. Smith's dental report; very satisfactory work has been done in this Department.

I wish also, sir, to express to yourself and to the other Honourable Members of the Cabinet my sincerest appreciation of your uniform support in all matters pertaining to the promotion of the Hospitals' best interests.

I have the honour to be,
Sir,
Your obedient servant,

C. E. DOHERTY,
Medical Superintendent.

LABORATORY REPORT.

Laboratory of Provincial Mental Hospital.
Coquitlam, B.C., January 1st, 1919.

Dr. C. E. Doherty,
Medical Superintendent, Public Hospital for the Insane,
New Westminster, B.C.

Sir,—I have the honour herewith to report work done during 1918. The cleaning-up of the outbreak of diphtheria which commenced in December, 1917, occupied most of the time during the first two months of the year, and in all 3,000 cultures were taken.

It was found necessary to close the Laboratory for four months to carry on the work of the Clinical Clerk, and Mr. Gooding carried on this work until a stenographer was obtained.

A routine Wassermann blood test for syphilis was made on each admission if at all possible, and a positive reaction of 13.64 per cent. obtained on the year's admissions. The test was also applied to some of our older admissions, and a total number of 445 examinations were made. An acetone insoluble fraction antigen, checked by a cholesterin reinforced alcoholic extract of human heart antigen, gave most satisfactory results. The cholesterin antigen, being more sensitive, picked up many positive reactions not held by the acetone insoluble one. In addition, each patient's serum was tested for natural anti-sheep amboceptor and removed if present, thus ensuring against a false negative reaction.

Routine work done was as follows:—

(*a.*) Autopsies done, sections made and filed.

(*b.*) Blood examinations—

Complete counts	21
Differential counts	14
Wassermann test for syphilis	445

(*c.*) Cultures—

Nose and throat	1,950
Blood	3
Abscesses	2

(*d.*) Fluids—

Plueral effusions	4

(*e.*) Miscellaneous—

Urinalyses	452
Sputa for T.B.	46
Vidal agglutination tests (triple)	6
Fæces for occult blood	2
Fæces, chemical examination	1
Wassermann test on spinal fluid	2
Noguchi's test for excess globulin	2
Smears from urethra for Gc	2
Smears for Vincent's angina	6
Smears for actinomycosis	3
Smears for streptococci	3
Vaccines (autogenous)	2
Guinea-pigs inoculated for T.B.	10

(*f.*) Work done for the farm.

All animals which died during the year were autopsied, and in every case where possible assistance was rendered to make a diagnosis of the condition, so that isolation and treatment could be carried out more judiciously. Weekly milk-counts were done, showing very low bacterial counts. Cultures from abscesses and infections were always taken to ascertain the offending organism.

In conclusion, I wish to extend my thanks to Mr. Gooding for the accurate work done and the keen interest shown by him during the year.

I have, etc.,

A. L. Crease,
Assistant Medical Superintendent and Pathologist.

DENTAL RPOERT.

PUBLIC HOSPITAL FOR THE INSANE,
NEW WESTMINSTER, B.C., January 24th, 1919.

Dr. C. E. Doherty,
Medical Superintendent, Public Hospital for the Insane,
New Westminster, B.C.

SIR,—I beg to report the following dental work done on patients in the Mental Hospitals, New Westminster and Essondale, during the year 1918, working two days per month:—

Pyorrhœa treatments	33
Extractions	494
Prophylactic treatment	109
Amalgam fillings	121
Synth. porcelain fillings	13
Cement fillings	9
Root fillings	4
Dentures	11
Repairs, bridge	3
Repairs, dentures	10
Abscesses treated	5
Porcelain crowns	2
Fractures treated	2
Dentures trimmed	5
Refitting and setting gold crown	2

I have, etc.,

F. P. SMITH, D.D.S.

STATISTICAL TABLES.

Table No. 1.

Showing the Operations of the Hospitals, New Westminster and Essondale, for the Year 1918, in Summary Form.

Movement of Population.	Male.	Female.	Total.	Total. Male.	Total. Female.	Total. Total.
In residence, New Westminster, December 31st, 1917	213	349	562			
" Essondale, December 31st, 1917	739	..	739			
On probation, carried forward from 1917, New Westminster	9	33	42			
" " " Essondale	22	..	22			
Escaped, carried forward from 1917, New Westminster	8	..	8			
" " Essondale	5	..	5	996	382	1,378
Admitted during 1918—						
By ordinary forms	218	137	355			
By urgency forms	6	6	12			
From the Yukon	3	..	3			
Order in Council	4	1	5	231	144	375
Total under treatment, New Westminster and Essondale, for year 1918.	..	..	..	1,227	526	1,753
Discharged during 1918:						
From New Westminster—						
As recovered	21	32	53			
As improved	11	15	26			
As unimproved	11	7	18			
Not insane	1	..	1			
On probation and still out	19	54	73			
Escaped, but not discharged	3	..	3			
Died	42	35	77			
	108	143	251			
From Essondale—						
As recovered	21	..	21			
As improved	33	..	33			
As unimproved	18	..	18			
On probation and still out	22	..	22			
Escaped, but not discharged	6	..	6			
Died	55	..	55			
	155	..	155			
Total discharged from New Westminster and Essondale	..	..	..	263	143	406
Total in residence, New Westminster and Essondale, December 31st, 1918.	..	..	..	964	383	1,347
New Westminster—						
Total on books, December 31st, 1917	230	382	612			
Admissions during 1918	231	144	375			
Returned from Essondale	25	..	25	486	526	1,012
Discharged during 1918	108	143	251			
Transferred to Essondale during 1918	165	..	165	273	143	416
Total in residence, New Westminster, December 31st, 1918	..	..	..	213	383	596
Essondale—						
Total on books, December 31st, 1917	766	..	766			
Transferred from New Westminster during 1918	165	..	165	931	..	931
Discharged during 1918	155	..	155			
Returned to New Westminster during 1918	25	..	25	180	..	180
Total in residence, Essondale, December 31st, 1918	..	..	..	751	..	751
Total in residence, New Westminster, December 31st, 1918	..	..	..	213	383	596
Grand total in residence, New Westminster and Essondale, Dec. 31st, 1918.	..	..	..	964	383	1,347

Daily average population	1,338.16
Maximum number present any one day	1,360.00
Minimum " "	1,301.00
Percentage of discharges on admissions	45.35
" recoveries on admissions	20.00
" deaths on whole number under treatment	7.47

TABLE No. 2.

Showing in Summary Form the Operations of the Hospital since its Inception.

Year.	Admissions.	Discharges.		Deaths.	Number Resident at the Close of each Year.	Increase.	Decrease.	Whole Number treated.	Percentage of Recoveries to Admissions.	Percentage of Discharges to Admissions (Deaths excluded).	Percentage of Deaths to Whole Number under Treatment.
		Recovered.	Not recovered.								
1872	18	1	..	1	16	..	..	18	5.55	5.55	5.55
1873	15	10	2	5	14	..	2	31	66.66	80.00	16.12
1874	12	4	..	3	19	5	..	26	33.33	33.33	11.53
1875	29	3	3	10	32	13	..	48	10.34	26.89	20.83
1876	22	11	3	5	35	3	..	54	50.00	63.63	9.35
1877	14	4	4	3	38	3	..	49	28.57	78.57	6.12
1878	16	7	3	8	36	..	2	54	43.75	62.50	16.16
1879	18	4	1	8	41	5	..	54	22.22	27.77	14.81
1880	17	5	..	5	48	7	..	58	29.41	29.41	8.62
1881	13	5	3	5	48	..	..	61	38.46	61.54	8.19
1882	7	3	1	2	49	1	..	55	42.85	57.14	3.63
1883	8	4	1	3	49	..	..	57	50.00	62.50	5.26
1884	10	2	4	2	51	2	..	59	20.00	60.00	3.33
1885	20	5	..	5	61	10	..	71	25.00	25.00	6.94
1886	27	10	6	6	66	5	..	88	37.03	59.25	6.81
1887	36	15	5	5	77	11	..	102	41.66	55.55	4.80
1888	26	12	6	3	82	5	..	103	46.15	69.23	2.87
1889	41	14	5	4	100	18	..	123	34.15	46.34	3.25
1890	52	17	6	12	117	17	..	152	32.69	44.23	7.64
1891	49	19	4	20	123	6	..	166	38.77	46.94	11.69
1892	52	17	10	13	135	12	..	175	32.69	51.92	6.95
1893	44	14	18	14	133	..	2	179	31.81	72.72	7.60
1894	80	13	19	19	162	29	..	213	16.25	40.00	8.92
1895	62	29	11	20	164	2	..	224	46.77	64.51	8.92
1896	64	23	25	9	171	7	..	228	35.93	75.00	3.94
1897	74	20	8	14	203	32	..	246	27.03	37.83	5.69
1898	81	27	13	19	221	18	..	285	33.33	49.38	6.66
1899	101	31	32	21	234	13	..	327	30.69	62.37	6.42
1900	113	38	27	29	258	24	..	356	33.63	57.52	8.14
1901	115	40	20	25	284	26	..	377	34.78	52.17	6.63
1902	121	30	31	25	311	27	..	413	24.79	50.41	6.06
1903	139	38	37	26	349	38	..	466	27.34	53.96	5.57
1904	115	46	26	26	321	..	28	480	40.00	62.61	5.42
1905	123	43	33	27	348	27	..	505	33.33	61.78	5.34
1906	150	36*	43	28	388	43	..	552	23.03	52.06	5.04
1907	221	48	43	39	461	73	..	666	21.30	41.20	5.08
1908	230	68*	56	57	507	46	..	765	28.30	53.90	7.44
1909	232	73†	77	40	536	29	..	816	31.00	64.60	6.40
1910	280	84	82	41	595	48	..	896	30.00	59.28	4.57
1911	332	67‡	114	60	690	105	..	1,034	19.57	54.42	5.83
1912	375	74*	128	76	752	62	..	1,065	18.90	53.80	7.02
1913	380	90‖	146	67	919	167	..	1,264	22.63	62.10	5.30
1914	402	58	126	74	1,027	108	..	1,364	14.43	45.77	5.43
1915	332	83	91	89	1,090	63	..	1,437	25.00	52.41	6.19
1916	353	73†	96	80	1,205	115	..	1,527	20.68	47.87	5.24
1917	371	88	78	106	1,301	96	..	1,650	23.72	44.74	6.42
1918	375	75	95	132	1,347	46	..	1,753	20.00	45.33	7.47

* Three not insane. † One not insane. ‡ Two not insane ‖ Four not insane.

Mental Hospital, Essondale.

TABLE No. 3A.

Showing the Number of Admissions, Discharges, and Deaths during 1918, New Westminster.

Months.	Admissions.			Discharges.			Deaths.		
	Male.	Female.	Total.	Male.	Female.	Total.	Male.	Female.	Total.
January	28	10	38	2	...	2	4	1	5
February	22	13	35	9	8	17	5	2	7
March	20	16	36	..	1	1	5	5	10
April	17	6	23	..	..	..	2	2	4
May	10	7	17	..	...	...	..	2	2
June	17	15	32	1	..	1	1	2	3
July	9	12	21	10	6	16	1	3	4
August	28	13	41	9	19	28	..	1	1
September	22	10	32	1	1	2	2	4	6
October	22	12	34	..	1	1	10	3	13
November	16	22	38	..	..	..	9	8	17
December	20	8	28	12	18	30	3	2	5
Totals	231	144	375	44	54	98	42	35	77

TABLE No. 3B.

Showing Number of Admissions, Discharges, and Deaths during 1918, Essondale.

Months.	Admissions, Males only.	Discharges, Males only.	Deaths, Males only.
January	10	1	4
February	16	1	3
March	11	..	2
April	18	17	3
May	15	1	3
June	14	10	3
July	9	..	6
August	22	..	5
September	18	..	2
October	15	2	4
November	5	23	17
December	7	17	3
Totals	160	72	55

TABLE No. 4.

Showing the Civil State of Patients admitted during 1918.

Civil State.	Male.	Female.	Total.
Single	140	36	176
Married	58	93	151
Widowed	8	15	23
Unknown	25	..	5
Totals	231	144	3725

TABLE No. 5.

Showing the Religious Denominations of those admitted during 1918.

Religious Denomination.	Male.	Female.	Total.
Buddhist	10	..	10
Christadelphian	1	..	1
Confucian	9	2	11
Doukhobor	1	1	2
Greek	2	1	3
Hebrew	..	3	3
Hindu	1	..	1
Mohammedan	1	..	1
Non-sectarian	1	..	1
Protestant, various denominations	148	112	260
Roman Catholic	41	23	64
Shinto	..	1	1
Unknown	16	1	17
Totals	231	144	375

TABLE No. 6.

Showing the Degree of Education of those admitted during 1918.

Degree of Education.	Male.	Female.	Total.
Superior	14	13	27
Common school	145	107	252
Very little	51	14	65
None	14	10	24
Unknown	7	..	7
Totals	231	144	375

TABLE No. 7.

Showing the Nationality of those admitted during 1918.

Nationality.	Male.	Female.	Total.
Australia	..	1	1
Austria	15	2	17
China	16	1	17
Cyprus	1	..	1
Denmark	1	..	1
England	50	24	74
Finland	3	1	4
France	..	1	1
Germany	7	1	8
Holland	1	1	2
Iceland	..	2	2
India	3	..	3
Ireland	6	5	11
Italy	4	4	8
Japan	9	1	10
Montenegro	2	..	2
Orkney Islands	..	1	1
New Zealand	1	..	1
Newfoundland	..	2	2
Norway	6	3	9
Russia	2	3	5
Scotland	12	16	28
Spain	1	..	1
Sweden	15	1	16
Switzerland	1	1	2
Turkey	1	..	1
United States	22	13	35
Wales	3	2	5
Yukon	..	1	1
Unknown	1	..	1
Canada—			
British Columbia	15	16	31
Cape Breton	1	..	1
Manitoba	3	6	9
New Brunswick	1	1	2
Nova Scotia	5	2	7
Ontario	16	24	40
Saskatchewan	1	..	1
Quebec	3	8	11
Canada	3	..	3
Totals	231	144	375

TABLE No. 8.

Showing what Districts contributed Patients during 1918.

Place of Residence at Time of Committal.	Male.	Female.	Total.
Abbotsford	..	1	1
Aldergrove	..	1	1
Anyox	..	1	1
Appledale	1	..	1
Armstrong	1	..	1
Banff, Alberta	..	1	1
Bowser	1	1	2
Brilliant	1	..	1
Britannia Beach	1	..	1
Burnaby	5	1	6
Chilliwack	3	..	3
Clinton	..	1	1
Cloverdale	1	1	2
Collingwood East	1	..	1
Colquitz	1	..	1
Courtenay	1	..	1
Cranbrook	1	2	3
Dawson, Y.T	2	..	2
East Delta	1	..	1
Edgewood	..	1	1
Esquimalt	2	1	3
Fernie	2	2	4
Glen Valley	..	1	1
Golden	2	..	2
Granby Bay	1	..	1
Grand Forks	1	..	1
Hagwilgit Indian Reserve	..	1	1
Hazelton	1	..	1
Harrison Mills	1	..	1
Hastings Park	1	..	1
Hat Creek	1	..	1
Hope	1	..	1
Iddesleigh, Alberta	1	..	1
Kamloops	3	..	3
Kelowna	1	1	2
Kerrisdale	..	1	1
Lac la Hache	1	..	1
Ladner	2	1	3
Ladysmith	1	..	1
Lion Island	..	1	1
Lucerne	..	1	1
Masset	1	..	1
Maple Bay	..	1	1
Marpole	1	1	2
Matsqui	1	..	1
Morrissey	1	..	1
Nanaimo	4	2	6
Nelson	5	2	7
New Westminster	8	8	16
Nicola	1	..	1
North Vancouver	6	..	6
Oak Bay	..	1	1
Ocean Falls	2	..	2
Oakalla Prison	3	..	3
Okanagan Landing	1	..	1
Penticton	1	2	3
Phoenix	1	..	1
Pincher Creek, Alberta	1	..	1
Point Grey	1	1	2
Port Coquitlam	1	2	3
Prince Rupert	3	2	5
Princeton	3	..	3
Quathiaski Cove	3	..	3
Quatsino	..	1	1

TABLE No. 8—*Concluded.*

Place of Residence at Time of Committal.	Male.	Female.	Total.
Radium	1	..	1
Revelstoke	2	3	5
Rivers Inlet	1	..	1
Rock Bay	2	..	2
Rosedale	..	1	1
Saanich	..	2	2
Salmon Arm	..	1	1
San Francisco, Cal	1	..	1
Sidney	..	1	1
South Fort George	1	..	1
South Pender Island	..	1	1
South Vancouver	1	3	4
Strawberry Hill	1	..	1
Sunshine Bay	..	1	1
Telegraph Creek	1	..	1
Terrace	1	..	1
Trail	..	1	1
Vancouver	94	56	150
Vernon	10	4	14
Victoria	23	23	46
Voght Valley	..	1	1
West Vancouver	..	1	1
White Horse, Y.T.	1	..	1
White Rock	..	1	1
Totals	231	144	375

TABLE No. 9.

Showing the Occupations of those admitted during 1918.

Occupation.	Male.	Female.	Total.
Advertisement solicitor	1	..	1
Architect	1	..	1
Baker	1	..	1
Barber	2	..	2
Blacksmith	1	..	1
Boiler-maker	1	..	1
Book-keeper	2	..	2
Bushelman	1	..	1
Carpenter	11	..	11
Chauffeur	1	..	1
Clergyman	1	..	1
Clerk	4	2	6
Contractor	2	..	2
Cook	2	..	2
Domestic	..	6	6
Draper	1	..	1
Draughtsman	1	..	1
Electrician	2	..	2
Engineer	4	..	4
Farmer	12	..	12
Farm-labourer	4	..	4
Filer	1	..	1
Fireman	4	..	4
Fisherman	4	..	4
Gardener	1	..	1
Homesteader	1	..	1
Hotelkeeper	1	..	1
Housekeeper	..	9	9
Housewife	..	95	95
Immigration officer	1	..	1
Insurance agent	1	..	1
Labourer	86	..	86
Laundry-worker	1	1	2
Logger	6	..	6
Longshoreman	1	..	1
Lumberman	2	..	2
Manufacturer	1	..	1
Milliner	..	1	1
Miner	10	..	10
Music-teacher	..	1	1
Needlewoman	..	2	2
Nurse	..	4	4
Orderly	2	..	2
Painter	1	..	1
Peddler	1	..	1
Photographer	2	..	2
Policeman	1	..	1
Polisher	1	..	1
Postmaster	1	..	1
Pre-emptor	..	1	1
Professor	1	..	1
Prostitute	..	1	1
Rancher	9	..	9
Retired	2	..	2
Sailor	1	..	1
Shipwright	2	..	2
Soldier	9	..	9
Stenographer	1	3	4
Stone-mason	1	..	1
Student	..	1	1
Teacher	1	1	2
Telephone operator	..	1	1
Tinsmith	1	..	1
Trapper	1	..	1
Wireman	1	..	1
No occupation	12	13	25
Unknown	4	2	6
Totals	231	144	375

TABLE No. 10.

Showing the Ages of those admitted during 1918.

Age.	Male.	Female.	Total.
Under 15 years	3	3	6
From 15 to 20 years	8	3	11
" 20 to 25 "	24	14	38
" 25 to 30 "	28	22	50
" 30 to 35 "	37	23	60
" 35 to 40 "	33	23	56
" 40 to 45 "	24	13	37
" 45 to 50 "	26	14	40
" 50 to 55 "	7	10	17
" 55 to 60 "	11	1	12
" 60 to 65 "	11	5	16
" 65 to 70 "	7	5	12
" 70 to 75 "	4	4	8
" 75 to 80 "	3	3	6
Over 80 years	5	1	6
Totals	231	144	375

TABLE No. 11.

Showing the Number of Attacks in those admitted during 1918.

Number of Attacks.	Male.	Female.	Total.
First	163	104	267
Second	34	25	59
Third	2	4	6
Fourth	2	6	8
Fifth	..	2	2
Several	1	2	3
Unknown	28	1	29
Not insane	1	..	1
Totals	231	144	375

TABLE No. 12.

Showing the Alleged Duration of Attack prior to Admission.

Duration of Attack.	Male.	Female.	Total.
Under 1 week	34	27	61
From 1 " to 1 month	52	41	93
" 1 to 3 months	27	14	41
" 3 to 6 "	17	13	30
" 6 to 12 "	22	11	33
" 1 to 2 years	16	1	17
" 2 to 5 "	14	14	28
" 5 to 10 "	7	7	14
" 10 to 15 "	2	3	5
Over 15 years	4	4	8
Unknown	35	9	44
Not insane	1	..	1
Totals	231	144	375

TABLE No. 13.

Showing Statistics of Heredity in those admitted during 1918.

Heredity.	Male.	Female.	Total.
Paternal and maternal branches	1	1	2
Paternal branch	5	7	12
Maternal branch	4	11	15
Lateral branches	2	3	5
Heredity, inferred	44	40	84
Unknown	174	82	256
Not insane	1	..	1
Totals	231	144	375

TABLE No. 14.

Showing the Alleged Exciting Cause of Attack of Insanity in those admitted during 1918.

Alleged Cause.	Male.	Female.	Total.
Alcohol	8	..	8
Arteriosclerosis	3	1	4
Cardiorenal disease	..	1	1
Cerebral tumour	1	..	1
Drugs	1	2	3
Epilepsy	3	1	4
Hemiplegia	..	1	1
Heredity, ascertained	12	22	34
Heredity, inferred	44	40	84
Old age	20	10	30
Pregnancy	..	5	5
Shell shock	4	..	4
Solitude	6	1	7
Strain of military service	4	..	4
Syphilis	33	8	41
Traumatic	4	..	4
Toxic	8	7	15
Worry	16	4	20
Unknown	63	41	104
Not insane	1	..	1
Totals	231	144	375

TABLE No. 15.

Showing the State of Bodily Health of those admitted during 1917.

Bodily Condition.	Male.	Female.	Total.
In average bodily health	195	114	309
In reduced health	25	25	50
In greatly reduced health	11	5	16
Totals	231	144	375

Dormitory, New Mental Hospital, Essondale.

TABLE No. 16.

Showing the Form of Mental Disorder in those admitted during 1918.

Form of Disorder.	Male.	Female.	Total.
Cerebral syphilis	..	1	1
Delusional insanity	..	1	1
Dementia præcox	78	20	98
Epileptic insanity	9	4	13
General paresis	26	5	31
Idiocy and imbecility	8	6	14
Mania, acute	..	2	2
Mania, depressive condition	54	70	122
Melancholia	1	..	1
Paranoia	22	14	36
Puerperal	..	1	1
Senile dementia	22	9	31
Terminal dementia	3	2	5
Toxic insanity	8	9	17
Traumatic insanity	1	..	1
Not insane	1	..	1
Totals	231	144	375

TABLE No. 17A.

Showing the Number allowed out on Probation and Results during 1918, New Westminster.

Results.	Male.	Female.	Total.
Discharged recovered	21	32	53
" improved	11	15	26
" unimproved	11	7	18
" not insane	1	..	1
Returned to Hospital	5	26	31
Still out at close of year	20	53	73
Totals	69	133	202

TABLE No. 17B.

Showing the Number allowed out on Probation and Results during 1918, Essondale.

Results.	Males only.
Discharged recovered	12
" improved	14
" unimproved	7
Returned to Hospital	14
Still out at close of year	22
Total	69

TABLE No. 18A.

Showing the Alleged Duration of Insanity prior to Admission in those discharged from New Westminster during 1918.

Duration of Insanity.	Male.	Female.	Total.
Less than 1 week	6	8	14
" 1 month	11	17	28
From 1 to 2 months	2	9	11
" 2 to 3 "	3	3	6
" 3 to 6 "	9	9	18
" 6 to 12 "	3	3	6
" 1 to 2 years	3	1	4
" 2 to 3 "	1	..	1
Over 3 years	2	2	4
Unknown	3	2	5
Not insane	1	..	1
Totals	44	54	98

TABLE No. 18B.

Showing the Alleged Duration of Insanity prior to Admission in those discharged from Essondale during 1918.

Duration of Insanity.	Males only.
Less than 1 week	15
" 1 month	14
From 1 to 2 months	10
" 3 " 6 "	4
" 1 " 2 years	10
Unknown	19
Total	72

TABLE No. 19A.

Showing the Length of Residence of those who were discharged from New Westminster during 1918.

Length of Residence.	Discharged recovered.	Discharged improved.	Discharged unimproved.	Not insane.
Less than 1 month	4	3	3	1
From 1 to 2 months	7	2	3	..
" 2 " 3 "	10	2	3	..
" 3 " 4 "	3	5	..	..
" 4 " 5 "	7	2	..	..
" 5 " 6 "	3	3	..	..
" 6 " 9 "	9	3	5	..
" 9 " 12 "	2	4	1	..
" 1 " 2 years	4	2	2	..
" 2 " 3 "	3	..	1	..
" 3 " 4 "	..	..	..	..
" 5 " 6 "	1	..	..	..
Totals	53	26	18	1

TABLE No. 19B.

Showing the Length of Residence of those who were discharged from Essondale during 1918.

Length of Residence.	Discharged recovered.	Discharged improved.	Discharged unimproved.
From 1 to 2 months	5	..	..
" 3 " 4 "	1	5	3
" 5 " 6 "	2	8	3
" 6 " 9 "	4	6	..
" 9 " 12 "	2	3	1
" 1 " 2 years	3	3	3
" 2 " 3 "	2	4	4
" 3 " 4 "	2	..	1
" 4 " 5 "	..	2	..
" 7 " 8 "	..	..	1
Over 8 years	..	2	2
Totals	21	33	18

TABLE No. 20A.

Records of Deaths for the Year 1918, New Westminster.

Register No.	Initials.	Sex.	Age.	Time in Hospital.			Certified Cause.
				Years.	Months.	Days.	
4863	W. B.	M.	3⅔	1	5	24	General tuberculosis.
5238	E. V. B.	M.	61	..	4	11	Toxemia of acute cystitis.
4538	A. H. C.	M.	57	2	5	4	General paralysis.
5371	M. S.	M.	35	..	..	15	Acute streptococcic cellulitis of right arm.
4447	J. S.	F.	68	2	8	23	Exhaustion of senile dementia.
5392	A. A.	M.	80	..	..	10	Broncho pneumonia.
5285	E. K.	M.	62	..	3	19	Exhaustion of senile dementia.
5417	J. McC.	F.	54	..	..	8	Exhaustion of acute mania.
5327	J. H. D.	M.	37	..	2	25	Vincenti angina.
5361	W. H. M.	M.	70	..	1	25	Exhaustion of senile dementia.
5423	B. B.	M.	73	..	..	6	Exhaustion of senile dementia.
5363	M. I. Y.	F.	60	..	2	..	Toxemia of burns.
5395	E. M.	F.	45	..	1	10	Tabo-paresis.
3157	L. E. W.	F.	33	6	2	8	Status-epilepticus.
5443	P. E. W.	M.	45	..	..	10	Exhaustion of general paresis.
5450	O. A. O.	M.	77	..	..	5	Exhaustion of senile dementia.
2651	J. C.	M.	69	7	9	6	Trombus of lateral sinus.
4990	A. M. W.	F.	51	1	2	20	Exhaustion of general paresis.
5429	J. L.	M.	85	..	..	24	Rodent ulcer of face.
3773	D. B. S.	F.	47	4	7	3	Endocarditis with broken compensation.
5137	W. McD.	M.	71	..	9	30	Cellulitis of face.
1836	M. J. W.	F.	38	11	4	8	Pulmonary tuberculosis.
5412	M. R. D.	F.	40	..	2	3	Cerebral syphilis.
4886	K. McR.	M.	27	1	8	4	Exhaustion of dementia præcox.
4828	W. Y.	M.	77	1	10	7	Chronic endocarditis.
4002	H. A.	F.	51	3	1	8	Carcinoma of stomach.
4857	F M. C.	F.	17	1	9	16	Status epilepticus
5283	L. F.	F.	41	..	7	10	Exhaustion of general paresis.
4294	M. E.	F.	49	3	6	9	Exhaustion of mania.
4106	M. B. B.	F.	28	3	11	18	Pulmonary tuberculosis.
5474	W. C.	M.	47	..	3	30	Exhaustion of general paralysis.
5509	R. P.	F.	42	..	1	25	Interstitial nephritis.
5341	S. B.	M.	43	..	7	9	Tubercular meningitis.
5480	M. D.	F.	41	..	3	11	Paraplegia following myelitis.
5269	K. B. F.	F.	59	..	9	17	Exhaustion of acute mania.
5245	L. A.	F.	33	..	11	16	Tubercular adenitis and pulmonary tuberculosis.
4648	E. A. L.	F.	36	2	1	7	Epidemic of diarrhœa.
5535	L. B.	F.	71	..	3	5	General paralysis.
5519	T. A. W. W.	M.	35	..	3	21	General paralysis.
5434	E. A. E.	M.	41	..	6	26	Exhaustion of pernicious anæmia.
5294	C. L. K.	F.	55	..	11	..	Cerebral hæmorrhage.
5160	F. B. B.	F.	6	1	3	4	Exhaustion of idiocy.
5538	E. M. N.	F.	50	..	3	14	Exhaustion of exophthalmic goitre.
5648	H. T.	M.	22	..	..	8	Strangulation.
5295	L. S.	F.	16	..	11	19	Pulmonary tuberculosis.
4878	S. Y. W.	M.	57	2	..	6	Exhaustion from inanition.
5632	J. B.	M.	35	..	1	3	Pneumonia.
5518	R. S.	M.	45	..	4	26	General paresis of the insane.
3485	J. B.	M.	35	5	11	4	Pneumonia.
2884	J. A. L.	M.	20	7	7	5	Pneumonia.
5365	M. O. M. D.	M.	20	..	10	..	Pneumonia.
1903	G. W. B.	M.	22	11	7	10	Pneumonia.
1445	S. W. C.	M.	50	15	..	16	Pneumonia.
3612	P. McK.	M.	60	5	7	10	Exhaustion of general paralysis.
5664	W. A. G.	M.	62	..	..	8	Cerebral hæmorrhage.
5661	K. M.	F.	27	..	..	8	Exhaustion of acute mania.
5035	G. D.	M.	61	1	8	24	Pneumonia.
5638	A. M.	F.	38	..	1	10	Pneumonia.
3365	F. G. B.	M.	30	6	5	26	Pneumonia.
1490	N. T.	M.	33	14	8	22	Pneumonia.
2701	G. P.	F.	35	8	2	19	Pneumonia.

TABLE No. 20A—*Concluded.*

Records of Deaths for the Year 1918, New Westminster—*Concluded.*

Register No.	Initials.	Sex.	Age.	Time in Hospital.			Certified Cause.
				Years.	Months.	Days.	
4892	S. E. B.	F.	42	2	2	11	Influenza.
2920	M. B.	F.	30	7	5	26	Pneumonia.
5683	M. S.	F.	77	..	..	2	Exhaustion of senile dementia.
5479	R. McC.	M.	47	..	7	5	Exhaustion of general paralysis.
5557	J. B.	F.	47	..	3	27	Exhaustion of depressive psychosis.
5669	A. N.	M.	68	..	..	24	Exhaustion of senile dementia.
5502	A. W.	F.	35	..	6	18	Exhaustion of general paralysis.
1872	D. S. S.	M.	79	11	10	23	Cerebral hæmorrhage.
3080	A. H. C.	M.	47	7	1	9	Surgical emphysema.
5402	B. H.	M.	55	..	10	2	Exhaustion of general paralysis.
5544	J. F.	F.	63	..	5	2	Exhaustion of senile dementia.
5530	I. M.	F.	46	..	5	22	Cerebral embolism.
5687	G. T.	M.	37	..	1	5	Myocarditis with broken compensation.
5720	C. B.	F.	55	..	..	10	Exhaustion of depressive psychosis.
1982	J. W.	M.	58	11	4	20	Myocarditis.
4829	J. C. T.	M.	26	2	6	9	Acute dilatation of stomach.

TABLE No. 20B.

Record of Deaths for the Year 1918, Essondale.

Register No.	Initials.	Sex.	Age.	Time in Hospital.			Certified Cause.
				Years.	Months.	Days.	
4781	A. F. McD.	M.	69	1	7	17	Exhaustion of senile dementia.
4724	J. C. C.	M.	79	1	9	25	Exhaustion of senile dementia.
3006	S. S.	M.	32½	3	5	25	Pulmonary tuberculosis.
1922	Z. S.	M.	30	10	9	6	Pulmonary tuberculosis.
4150	D. C.	M.	64	3	7	..	Exhaustion of senile dementia.
4916	W. K.	M.	35¾	1	5	..	Cerebral hæmorrhage.
5199	T. A. R. M.	M.	33	..	6	20	Exhaustion of dementia præcox.
4498	T. M.	M.	72	2	7	..	Exhaustion of senile dementia.
5195	W. K.	M.	52½	..	7	7	Cerebral hæmorrhage.
5051	W. G. M.	M.	70	1	1	18	(Carcinoma).
4250	J. M.	M.	44	3	6	..	Exhaustion of general paresis.
4685	T. H.	M.	51	2	2	18	Pernicious anæmia.
1472	B. C. H.	M.	72	14	3	25	Chronic nephritis.
5073	R. T.	M.	57	1	2	..	Exhaustion of general paresis.
4974	C. J.	M.	17	1	5	12	Idiocy.
3104	T. C.	M.	35	6	7	..	Pulmonary tuberculosis.
3534	J. T. T.	M.	55	5	5	..	Bacteræmia.
4484	M. L.	M.	36	3	..	11	Bronchopneumonia.
4431	J. S. B.	M.	65	3	3	..	Cerebral hæmorrhage.
1326	C. W. S. S.	M.	46	15	7	..	General tuberculosis.
5376	R. E. M.	M.	57	..	6	..	Strangulation (self-inflicted).
4747	A. C.	M.	44	2	3	..	Exhaustion of general paresis.
5132	M. K.	M.	38	..	1	28	Exhaustion of general paresis.
5550	W. R.	M.	60	..	..	24	Exhaustion of senile dementia.
1963	M. McD.	M.	38	11	..	..	Pulmonary tuberculosis.
2389	E. S.	M.	30	11	5	..	Pulmonary tuberculosis.
5272	J. W. McK.	M.	55	..	10	15	Exhaustion of senile dementia.
5263	J. A. McL.	M.	44	..	10	22	Cerebral hæmorrhage.
4929	Y. Y.	M.	52	1	10	14	Cerebral hæmorrhage.
5247	F. E. B.	M.	29	..	11	21	Pulmonary tuberculosis.
5461	M. J. J.	M.	31	..	5	14	Pulmonary tuberculosis.
4776	C. H.	M.	76	2	5	2	Chronic nephritis.
1176	S. U.	M.	50	16	11	4	Pneumonia.
3993	J. Y.	M.	47	3	7	28	Pneumonia (influenza).
5614	M. B.	M.	40	..	1	25	Pneumonia (influenza).
5098	T. W. B.	M.	35	1	6	18	Pneumonia (influenza).
5052	M. R.	M.	70	1	8	3	Exhaustion of senile dementia.
3868	H. E.	M.	20	4	11	15	Pneumonia (influenza.)
5141	A. B.	M.	30	1	5	1	Pneumonia (influenza).
4684	R. W. M.	M.	30	2	8	20	Exhaustion of general paresis.
576	R. G.	M.	57	24	4	10	Pneumonia (influenza).
4465	C. C.	M.	28	3	5	15	Pneumonia (influenza).
5608	I. (Indian).	M.	61	..	2	9	Pulmonary tuberculosis.
1572	W. J. D.	M.	27	3	11	12	Pneumonia (influenza).
2658	G. S.	M.	23	8	4	18	Pneumonia (influenza).
4336	W. E. M.	M.	37	3	9	5	Pneumonia (influenza).
5291	H. W. W.	M.	34	1	..	19	Exhaustion of general paresis.
4477	J. B.	M.	42	3	5	13	Myocarditis.
3743	J. C.	M.	36	5	3	29	Pulmonary tuberculosis.
4176	A. F.	M.	52	4	3	11	Cerebral hæmorrhage.
4715	H. P. A.	M.	30	2	8	12	Exhaustion of general paresis.
4806	H. A. McD.	M.	26	2	5	22	Pulmonary tuberculosis.
4983	A. A.	M.	45	1	11	21	Exhaustion of general paresis.
3728	C. M. C.	M.	24	5	5	2	Exhaustion of epilepsy.
5333	P. V.	M.	82	1	..	28	Exhaustion of senile dementia.

Table No. 21.

Showing Work done by Patients during the Year 1918 at New Westminster.

Work done by Patients.	Days.
Baker	1,011
Carpenter	622
Chicken-house	730
Dining-room	4,648
Engineer	730
Farmer	7,368
Florist	325
Gardener	3,839
Gate	365
Kitchen	2,348
Laboratory	365
Laundry	2,153
Lawns	1,385
Painter	996
Piggery	1,444
Plasterer	114
Plumber	309
Porter	100
Scullery	909
Shoemaker	794
Tailor	466
Ward-work	15,933

TABLE No. 22.

Articles made for Nurses, 1918.

Aprons	106	Cuffs, pairs	66
Caps	68	Dresses	45

Repairs for Nurses.

Aprons	256	Dresses	189

Articles made by Female Patients.

Aprons	224	Pillow-slips	611
Chemises	270	Sheets	710
Covers, bureau	8	Table-cloths	64
Curtains, pairs	30	Towels, bath	494
Dresses, gingham	112	„ hand	33
„ night	6	„ roller	297
Handkerchiefs	372	„ tea	233
Neckties	282	„ tray	148
Napkins, table	48		

Repairs for Female Patients.

Aprons	303	Pillow-slips	206
Blankets, wool	235	Sheets	671
„ strong	111	Shirts	1,296
Blouses	284	Spreads, bed	278
Chemises	735	Table-cloths	202
Drawers, pairs	1,340	Towels, bath	103
Dresses, gingham	1,307	„ roller	88
„ serge	558	Ticks, bed	179
„ night	909	Vests, under	1,078
Hose	11,354		

Mending done for Male Patients, 1918.

Aprons	254	Shirts, under	4,887
Blankets, wool	222	Socks, pairs	15,534
„ strong	4	Spreads, bed	306
Coats, white	69	Sweaters	71
Drawers, pairs	3,372	Table-cloths	210
Pillow-slips	61	Towels, bath	40
Sheets	1,205	„ roller	135
Shirts, over	4,896	Ticks, bed	75

Articles made for Essondale.

Aprons, kitchen	12	Caps for cooks	6
„ for cooks	12	Table-cloths	39
Bath-towels	100		

Poultry, Home Farm.

Eggs supplied to the institution, 898½ dozen at 60 cents		$ 539 15
Ducks, dressed, 62 at $1.50		93 00
Dressed poultry, 1,112 lb. at 35 cents		389 20
		$1,021 35
Stock on hand, December 31st, 1918—		
152 chickens at $1.80	$273 60	
6 ducks at $2	12 00	
		285 60
		$1,306 95

Patients' Day-room, New Mental Hospital, Essondale. (West Wing.)

TABLE No. 22—*Concluded.*

Poultry, Home Farm—Concluded.

Debits—		
Stock on hand, January 1st, 1918—		
100 chickens at $1	$100 00	
180 pullets and hens at $1.50	270 00	
13 ducks at $1.50	19 50	
Feed for poultry	582 40	
Quarter salary of man	251 00	
		1,222 90
Profit		$ 84 05

GARDEN PRODUCE, NEW WESTMINSTER, 1918.

Vegetables.

Green onions	565 lb.	at 3c.	$ 16 95	
Cooking-onions	425 „	„ 2½c.	10 62	
Vegetable marrow	3,968 „	„ 2½c.	99 20	
Pumpkins	2,816 „	„ 2½c.	70 40	
Ripe tomatoes	1,635 „	„ 8c.	130 80	
Green tomatoes	568 „	„ 4c.	22 72	
Peas	285 „	„ 10c.	28 50	
Early potatoes	2,475 „	„ 2½c.	61 87	
Late potatoes	2,580 „	„ 2c.	51 60	
Horse-radish	65 „	„ 10c.	6 50	
Carrots	14,980 „	„ 1c.	149 80	
Spinach and chard	15,091 „	„ 2½c.	377 27	
Beets	3,850 „	„ 2c.	77 00	
Turnips	2,500 „	„ 1½c.	37 50	
Cabbage	15,640 „	„ 2c.	312 80	
String beans	1,476 „	„ 8c.	118 08	
Celery	875 heads	„ 5c.	43 75	
Lettuce	325 dozen	„ 50c.	162 50	
Sweet corn	365 „	„ 35c.	127 75	
Parsnips	6,000 lb.	„ 2c.	120 00	
Cucumbers	645 „	„ 2c.	12 90	
Cauliflower	1,800 „	„ 10c.	180 00	
Estimated total value of vegetables				$2,218 51

Fruit.

Apples	27,625 lb.	at 5c.	$1,381 25	
Cherries	973 „	„ 10c.	97 30	
Plums	1,278 „	„ 8c.	102 24	
Pears	1,980 „	„ 12c.	237 60	
Peaches	45 „	„ 5c.	2 25	
Raspberries	349 „	„ 8c.	27 92	
Currants, black	65 „	„ 12c.	7 80	
„ red	1,093 „	„ 10c.	109 30	
Gooseberries	136 „	„ 10c.	13 60	
Strawberries	651 „	„ 12c.	78 12	
Rhubarb	4,675 „	„ 1½c.	70 12	
Estimated total value of fruit				2,127 50
Grand total				$4,346 01

TAILOR'S REPORT FOR 1918.

Uniforms made for City Institution—			
54 suits at $32	$1,728 00		
36 pairs of pants at $8	288 00		
		$2,016 00	
Patient's clothing, etc.—			
1 2-piece suit at $12.50	$ 12 50		
2 3-piece suits at $20.50	41 00		
31 3-piece suits at $16	496 00		
112 pairs of pants at $4.50	504 00		
28 pairs of pants at $5.50	154 00		
90 coats at $8	720 00		
31 coats at $11	341 00		
18 vests at $3.50	43 00		
30 canvas blankets (labour only)	30 00		
43 bed-ticks (labour only)	10 75		
17 pillows (labour only)	1 70		
Miscellaneous articles	32 85		
		2,386 00	
Repairs to clothing, City Institution—			
168 coats at 50 cents	$ 84 00		
77 vests at 30 cents	23 20		
432 pairs of pants at 40 cents	172 80		
		280 00	
Total for New Westminster			$ 4,682 00
Uniforms for Essondale Institution—			
86 suits at $32	$2,752 00		
75 pairs of pants at $8	600 00		
		$3,352 00	
Patients' clothing, etc.—			
12 suits clothes at $20	$ 240 00		
70 suits clothes at $16.50	1,155 00		
1 suit clothes at $16	16 00		
5 2-piece suits at $12.50	62 50		
7 coats at $11	77 00		
35 pairs of pants	174 50		
11 canvas coats at $3.50	38 50		
3 camisoles at $3	9 00		
		1,772 50	
Repairs to clothing, Essondale—			
1,160 coats at 50 cents	$ 580 00		
846 vests at 30 cents	253 80		
2,249 pairs of pants at 40 cents	899 60		
		1,733 40	
Total for Essondale			6,857 90
Grand total			$11,539 90

STATEMENT OF TAILOR-SHOP FOR 1918.

Credits, December 31st, 1918—			
Uniforms to Essondale	$3,352 00		
Patients' clothing, Essondale	1,772 50		
Repairs for Essondale	1,733 40		
		$6,857 90	
Uniforms for New Westminster	$2,016 00		
Patients' clothing, etc., New Westminster	2,386 80		
Repairs for clothing, etc., New Westminster	280 00		
		5,682 80	
Sale of cuttings (rags)		59 75	
Material on hand, December 31st, 1918		753 60	
			$13,354 05
Debits, December 31st, 1917—			
Stock on hand		$ 766 10	
Material purchased		7,002 34	
Salaries—			
Mr. Beggs	$1,078 00		
Mr. French	1,008 00		
Mrs. Huntley	588 00		
Mrs. Black	387 00		
Miss Pennington	379 00		
		3,440 00	
Electric power		39 50	
Electric light		30 00	
			11,277 94
Profit			$ 2,076 11

SHOEMAKER'S REPORT FOR 1918.

New work for house and stock—			
59 pairs of men's boots		$554 50	
127 pairs of men's slippers		334 75	
7 pairs of special boots		18 00	
			$ 907 25
Repairs for New Westminster—			
204 pairs of men's boots		$232 75	
47 pairs of men's slippers		52 45	
123 pairs of women's boots		114 80	
			400 00
Repairs for Essondale—			
633½ pairs of boots		$901 40	
399 pairs of slippers		323 80	
2 pairs of special boots		19 00	
			1,244 20
Miscellaneous			15 00
			$2,566 45

STATEMENT OF SHOEMAKER FOR 1918.

Credits—			
New work for City Institution	$ 907 25		
Repairs for City Institution	400 00		
Repairs for Essondale Institution	1,244 20		
Miscellaneous for City Institution	15 00		
		$2,566 45	
Stock of raw material on hand, December 31st, 1918		331 63	
Carried forward			$2,898 08

STATEMENT OF SHOEMAKER—*Concluded.*

Brought forward		$2,898 08
Debits—		
Salary of shoemaker	$ 920 00	
Material purchased in year	1,714 16	
Light and power used	31 75	
Stock on hand, January 1st, 1918	.....	
		2,665 91
Profit		$ 232 17

GREENHOUSE.

Bedding Plants, 1918.

Credits—			
18 plants at $1	$ 18 00		
12,943 „ 10c.	1,294 30		
300 „ 5c.	15 00		
5,510 „ 2c.	110 20		
		$1,437 50	
Cut flowers under glass		500 00	
Plants sent to Essondale—			
558 plants at 10c.	$ 55 80		
1,110 „ 2c.	22 20		
		78 00	
			$2,015 50
Debits—			
Coal used in boiler-room and greenhouse, 1918		$ 247 00	
Water used during year 1918		67 87	
Salary, gardener, year 1918		1,050 00	
Electric light		12 00	
			1,376 87
Profit			$ 638 63

FRUIT PUT UP AT NEW WESTMINSTER, 1918.

	Quarts.
Strawberries	49
Currants, black	65
„ red	40
Crab-apples	25
Pears	68
Plums	185
Rhubarb	55
Raspberries	18

PICKLES PUT UP AT NEW WESTMINSTER, 1918.

	Quarts.
Tomatoes	125

FRUIT PUT UP AT ESSONDALE INSTITUTION.

	Lb.
Currants	360
Pears	335
Plums	180

Provincial Mental Home, Saanich, B.C.

FRUIT AND PRESERVES PUT UP AT FARM COTTAGE.

Currants	15 gals.
Raspberries	25 „
Rhubarb	15 „
Sauerkraut	3 bbls.
String beans	2 „
Red cabbage	10 gals.

WORK DONE BY PATIENTS DURING THE YEAR 1918 AT ESSONDALE.

	Days.
Bake-shop	711
Billiard-room	4,543
Carpenter	1,126
Civil engineer	863
Dining-room	6,210
Engineer	2,268
Farm and garden	15,689
General parole	1,223
Grade and lawn	11,259
Kitchen	1,398
Laundry	6,083
Painter	783
Plasterer	2,188
Plumber	350
Poultryman	1,338
Scullery	1,460
Ward-work	25,806

FARM COTTAGE LABOUR REPORT.

	Days.
Farm-work	13,396
Kitchen	1,095
Dining-room	1,460
Ward-work	1,825
Stoker	365
Garden	582

CITY INSTITUTION STEWARD SUPPLIED ESSONDALE.

35½	dozen pairs of slippers	$ 264 00
13	coats at $8	104 00
35	vests at $3.50	122 50
27	pairs of pants at $4.50	121 50
1	2-piece suit of clothes	12 50
1	cap	50
	Total	$ 625 00

ESSONDALE SUPPLIED CITY INSTITUTION.

60,585	lb. ice at ½c.	$ 302 92
27	cords of wood at $6	162 00
583¾	lb. butter	350 25
50	pairs of blankets	767 50
	Total	$1,582 67

PRODUCE, HORSE-LABOUR, ETC., SUPPLIED ESSONDALE INSTITUTION BY COLONY FARM DURING 1918.

Dairy Department—		
Milk, 290,482 lb.	$11,782 61	
Butter, 3,150 lb.	1,890 00	
Cream, 162 lb.	32 40	
Buttermilk, 2,639 lb.	26 39	
		$13,731 40
Field-gardens—		
Vegetables, fruit, honey, flowers		10,667 51
Poultry Department—		
Eggs and fowl		3,108 47
Meats—		
Beef	$1,998 50	
Mutton and veal	469 80	
Pork, 21,443 lb.	5,789 61	
		8,257 91
Incidentals—		
Horse-labour 6,148 hours		2,459 20
Straw, 9 bales		9 00
Total		$38,233 49

PRODUCE SUPPLIED NEW WESTMINSTER INSTITUTION BY COLONY FARM DURING YEAR 1918.

Dairy products—		
Milk, 141,876 lb.	$5,751 23	
Cream, 348 lb.	69 60	
Buttermilk, 1,242 lb.	12 42	
		$ 5,833 25
Vegetables, fruit, and honey		3,249 73
Meats—		
Beef, 926 lb.	$ 189 83	
Mutton, 1,211½ lb.	263 55	
Pork, 13,614 lb.	3,880 78	
Fowl	27 75	
		4,361 91
Incidentals—		
Horse-labour, 2,367½ hours	$ 947 00	
Straw, etc.	40 10	
		987 10
Total		$14,431 99

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

PROVINCE OF BRITISH COLUMBIA

THIRTEENTH ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE YEAR 1918

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

I have the honour to submit for your consideration herewith the Annual Report of the Department of Agriculture for the year 1918.

E. D. BARROW,

Minister of Agriculture.

Department of Agriculture,

Victoria, B.C., March 26th, 1919.

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BRITISH COLUMBIA DEPARTMENT OF AGRICULTURE.

BRANCHES AND CHIEF STAFF MEMBERS, YEAR 1918.

Minister of Agriculture:

Hon. JOHN OLIVER.
Hon. E. D. BARROW.

Deputy Minister:

WM. E. SCOTT.
W. T. MCDONALD, Acting.

Secretary:

WM. J. BONAVIA.

Statistician:

A. B. TWEDDLE.

Secretary to Minister:

F. J. ROSSITER.
F. W. LAING.

Horticultural Branch:

M. S. MIDDLETON, B.S.A., Horticulturist and Inspector of Fruit Pests.
B. HOY, B.S.A., Assistant Horticulturist and Inspector of Fruit Pests.
E. W. WHITE, B.S.A., Assistant Horticulturist and Inspector of Fruit Pests.
P. E. FRENCH, B.S.A., Assistant Horticulturist and Inspector of Fruit Pests.
E. C. HUNT, B.S., Acting Assistant Horticulturist and Inspector of Fruit Pests.
W. H. ROBERTSON, B.S.A., Assistant Horticulturist and Inspector of Fruit Pests (on active service).
W. T. HUNTER, B.S.A., Assistant District Fruit Pest Inspector.
J. TAIT, Assistant District Fruit Pest Inspector.
H. H. EVANS, Assistant District Fruit Pest Inspector.
C. R. BARLOW, District Fruit Inspector.
H. GUTTERIDGE, Assistant Potato Inspector and Investigator of Potato-diseases.
R. C. ABBOTT, Coast Markets Commissioner and Inspector in Charge of Exports.
J. A. GRANT, Prairie Fruit Markets Commissioner, succeeding W. E. McTaggart.
J. L. HILBORN, in charge, Fruit and Vegetable Experimental Station, Summerland.
E. W. BUCKELL, Inspector on Codling-moth.

Imported Fruit Inspection Branch:

W. H. LYNE, Inspector of Imported Fruit and Nursery Stock, Rice, etc.
D. GAVET, Assistant Inspector of Imported Fruit and Nursery Stock, Rice, etc.
W. J. GRAHAM, Assistant Inspector of Imported Fruit and Nursery Stock, Rice, etc.
H. F. OLDS, Assistant Inspector of Imported Fruit, Vegetables, Rice, etc.

Plant Pathology and Entomology Branch:

J. W. EASTHAM, B.Sc., Plant Pathologist.
M. H. RUHMANN, Assistant Plant Pathologist.

Live Stock Branch:

W. T. MCDONALD, M.S.A., Live Stock Commissioner.
H. RIVE, B.S.A., Dairy Instructor and Inspector (on active service).
T. A. F. WIANCKO, Dairy Instructor and Inspector.
J. R. TERRY, Instructor in Poultry-raising.

Live Stock Branch—Concluded.

H. E. UPTON, Assistant Instructor in Poultry-raising.
H. O. ENGLISH, B.A., B.S.A., Soil and Crop Instructor.
E. W. HOGAN, B.S.A., Soil and Crop Instructor.
W. NEWTON, Soil and Crop Instructor (on active service).
G. C. HAY, B.S.A., Agriculturist.
Dr. A. KNIGHT, V.S., Veterinary Inspector.
Dr. S. A. K. WHITE, V.S., Assistant Veterinary Inspector.
Dr. W. W. ALTON, V.S., Assistant Veterinary Inspector.
Dr. B. R. ILSLEY, V.S., Assistant Veterinary Inspector.
E. RIVE, Official Milk-tester.
G. H. THORNBERY, Cow-tester.
J. W. CANDY, Cow-tester.
A. LEWARNE, Cow-tester.
E. F. WEETMAN, Cow-tester.
J. B. WATSON, Official Milk-tester.
R. J. FERRIS, Silo Demonstrator.
W. H. STROYAN, Poultry Caretaker.
R. CAHILTY, Brands Inspector.
J. W. MCKINLEY, Foreman, Quilchena Experimental Station.
E. BROOKLAND, Foreman, 105-Mile Experimental Station.

Foul-brood Inspectors:

F. D. TODD, Victoria. W. J. SHEPPARD, Nelson.
L. HARRIS, Vernon.

Women's Institutes:

Mrs. A. BLACKWOOD-WILEMAN, Chairman, Advisory Board, Duncan.
Mrs. A. L. TRASK, Oyama (member).
Mrs. F. B. FADDEN, Huntingdon (member).
Mrs. J. S. CHALMERS, Thrums (member).
Mrs. V. S. MACLACHLAN, Secretary, Advisory Board, R.F.D. No. 3, Victoria.

Accountant:

W. T. ANDREWS.

Clerical:

G. B. MARTIN.
G. L. FOULKES (on active service).
C. P. L. PEARSON.
GEO. PILMER.
R. E. MITCHELL.
J. H. BUCKETT.
G. H. STEWART (on active service).
G. HAWES.
E. T. WILLIAMS.
V. F. BABINGTON.
M. M. PATCHETT.
P. WARREN.
A. E. HILL.
A. V. EVANS.
D. MACKLIN.
M. G. BURNYEAT.

General:

A. H. SHOTBOLT, General Assistant.
D. E. MACKERETH, Carpenter.

Publications Branch:

M. A. STUART, Agriculturist and Acting-Editor.

REPORT OF THE DEPARTMENT OF AGRICULTURE.

REPORT OF THE ACTING DEPUTY MINISTER OF AGRICULTURE.

W. T. McDonald, M.S.A.

Hon. E. D. Barrow,
Minister of Agriculture, Victoria, B.C.

Sir,—I have the honour to submit herewith my report for the Department of Agriculture for the year 1918.

I was appointed Acting Deputy Minister of Agriculture on April 10th, 1918, owing to the serious illness of W. E. Scott, who resigned as Deputy Minister of Agriculture on August 31st, 1918.

Agricultural Conditions.

The winter of 1917-18 was fairly severe and was followed by a late spring. There was a very limited rainfall during the early part of the summer over Vancouver Island and adjacent islands, the Lower Mainland, and the Southern Interior, which was responsible for low yields of fall crops over the areas mentioned. In the range districts the conditions appeared very unfavourable for a time owing to the shortage of hay and pasture, but rains in the latter part of summer helped out the fall grazing, while a mild fall and more or less open weather till the end of the year have greatly improved the outlook. In the Central Interior portion of the Province traversed by the Grand Trunk Pacific Railway there was a liberal rainfall, with an abundance of rough feed. Much of the hay produced in this area was more or less injured by rain during the haying season, but, while rendered unsuitable for marketing purposes, an indirect benefit has resulted therefrom owing to the fact that it has encouraged the purchase of cattle, to which it is being fed on the farms. In this section of the Province the winter was extremely late, with the result that some of the grain-crops were more or less injured by early frosts.

As the war progressed the labour problem became more and more acute. This problem was met in the fruit districts by the introduction of girls as pickers, who deserve great credit for the loyal manner in which they did their part to support the efforts made along the lines of increased production.

Campaign for Increased Production.

In the 1918 session of the Legislature an Act was placed on the Statutes which provided for the setting-aside of $50,000 to be used in the purchase of seed-grain, which might be sold on time to farmers where there was difficulty in securing seed-grain locally. In this manner, much land was seeded to crop, which otherwise would have lain idle.

During the spring and early summer the services of G. S. Harris and H. C. Helgesen were secured in connection with the hog-production campaign, and incidentally to encourage dairy production as well. Both of these men have been successful hog-raisers, and their advice proved of great value in the districts which they visited. In this connection the Department decided that, instead of urging farmers indiscriminately to raise more hogs, it would be wise to urge the growing of pasture and other feed for hogs, and thus lower the cost of production. Where conditions appeared to be decidedly unfavourable for hog production, people were advised not to undertake the enterprise. As a result of this kind of a campaign we are satisfied that adequate results were secured without endangering the industry to a reaction which we felt would follow an indiscriminate campaign.

At this time I desire to place on record the patriotic co-operation of the farmers of the Province, who on every occasion nobly responded to the call for increased production.

Land Settlement.

There has been a considerable influx of settlers along the line of the Grand Trunk Pacific Railway in Central British Columbia, and with the cessation of the war we anticipate a rapid development of this portion of the Province. The Peace River District is also attracting settlers, and it is hoped that in the near future this important section of the Province will have railway facilities.

LIVE STOCK.

Horses.—The horse-breeding industry has been at a low ebb in the Province, and owing to the extremely high price of feed during the present winter all surplus horses that could be disposed of were sold in the fall. The result is that the number of horses in the Province now appears to have reached the minimum, and even with the encroaching competition of the tractor we anticipate that towards spring we will see the beginning of a good demand for draught horses of size and quality.

Beef Cattle.—There has been a tendency on the part of some of the largest operators in cattle-ranching to reduce their herds owing to the limited amount of range, but it is confidently expected that, under the new plan of administering the public ranges now being outlined by the Government, a much larger number of cattle can be carried than heretofore. A goodly number of beef cattle have been imported along the Grand Trunk Pacific from Alberta.

Dairying.—Owing to the high price of hay and grain there has been a tendency during the past fall on the part of some dairymen to reduce their herds, and in a few cases herds have been entirely dispersed. Taking the Province as a whole, however, there has been a marked increase in dairying during the year 1918.

Cow-testing Associations are proving an important factor in stimulating a keener interest in the care and management of the dairy herd, and as the work extends the results obtained will demonstrate the advantage to be gained by the dairy-farmers in availing themselves of this opportunity to secure assistance in placing their operations on an up-to-date business basis.

Dairy production has been greatly stimulated as the result of the campaign carried on by the Department for an increased number of silos, and at the present time Ontario is the only Province in Canada that has a greater proportion of silos than British Columbia, and it is expected that within a year or two this Province will stand first.

Hogs.—As the result of the patriotic appeal made at the early part of the year to farmers to raise more hogs there has been a marked increase in the production over that of last year. When the appeal was made the farmers responded in a whole-hearted manner, and on every hand there was evidenced a keen desire to assist in increasing the food-supply along this line.

Sheep.—During the year 1918 there has been an increased interest in sheep production owing to the high prices of wool and mutton that have prevailed. The number of sheep in the Province has shown an increase over the previous year, and this would have been much greater but for the difficulty in securing breeding stock and the high prices prevailing for the same. A large part of the wool produced in the Province is now marketed co-operatively, and the prices on the whole have been extremely gratifying to the grower. The proposed new grazing regulations will undoubtedly stimulate a much greater production of sheep in the Interior of the Province.

Goats.—The year 1918 has marked an important step in the development of this comparatively new industry in our Province. Through the activity of some of our British Columbia breeders a Canadian Goat Society has been organized, and herd-book registration has been established under the supervision of the National Live Stock Records Board. A number of high-priced animals have been imported into the Province from Great Britain and the United States, and doubtless the industry will assume considerable importance in the near future.

Poultry.—The poultry industry has shown no increase during the past year, but this was to be expected owing to the high price of feed that prevailed. Poultrymen who were so situated that it was necessary for them to purchase all of the feed required were particularly affected, but, notwithstanding, many have been able to show very satisfactory results at the end of the season. The situation that has prevailed has had a tendency to induce culling, with the result that the standard of excellence for the Province has been raised by a considerable degree.

VETERINARY INSPECTION.

During the year 15,705 head of cattle were tuberculin-tested, and 568 reactors were found. An effort was made to follow systematic testing of the herds not tested in the year 1917, but owing to the large number of requests for the testing of other herds it was found difficult to carry on the work in a systematic manner with the number of Inspectors on the staff.

There is a continued improvement in the sanitary conditions of the stables and dairies, with a marked tendency to replace old buildings with more modern structures.

HORTICULTURE.

Owing to the good prices prevailing for nearly all classes of fruit, fruit-growers on the whole have had a very satisfactory year. The yield of strawberries was greatly reduced by extremely dry weather at the time the crop was maturing. For the year 1917 the estimated value of the fruit-crop was $2,884,954, while for the past year it reached $4,415,160. The value of the vegetable-crop was almost double that of the previous year.

Statistics gathered relative to the production on city lots, show that the following was produced:—

Vegetables	$ 869,240
Poultry (dressed)	256,666
Eggs	595,448
Rabbits	75,000
Goats	700
Pigs	88,680
Dairy products	314,925
Veal	6,324
Honey	15,529
Total	$2,222,512

The Prairie and Coast Markets Commissioners have been of great assistance to fruit and vegetable growers, as well as to others in the Province, by keeping them in touch with market conditions and giving them information relative to the best methods of marketing their produce.

AGRICULTURAL STATISTICS.

Our Statistician of the Department has had the co-operation of the Dominion Statistician in collecting agricultural statistics of the Province. These statistics show an increase in nearly all lines of agricultural production, and while there is an increase of 10 per cent. in the value of our imports of agricultural products over the previous year, this difference is much more than offset by the increased prices that have prevailed.

AGRICULTURAL JOURNAL.

The *Agricultural Journal* has been in circulation for nearly three years, and during the past year its circulation has increased from 2,500 to 6,000. The effectiveness of this publication in spreading information to farmers throughout the Province has more than justified the undertaking, and is extremely gratifying to the Department.

CORRESPONDENCE.

The correspondence during the past year has shown a very marked increase, and is proof of the increasing use that is being made of the information furnished by the Department. This increase is particularly marked in the case of the Live Stock Branch, where it is approximately 30 per cent. over that of the previous year.

REPORTS OF STAFF OFFICIALS.

Appended hereto are the reports of various members of the staff of the Department, which furnish detailed information regarding the activities carried on by these officials.

All of which is respectfully submitted.

W. T. MCDONALD,
Acting Deputy Minister.

REPORT OF PROVINCIAL HORTICULTURIST AND INSPECTOR OF FRUIT PESTS.

M. S. MIDDLETON, B.S.A.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—I have the honour to report on the work of the Horticultural Branch for the period from January 1st, 1918, to November 15th, 1918.

OFFICIALS.

The staff has been well maintained considering present existing conditions. P. E. French, B.S.A., Assistant Horticulturist in the Vernon section, resigned on June 15th of this year, after seven years of faithful and valuable service. B. Hoy, Assistant Horticulturist at Kelowna, took over the Vernon territory in addition to his own. Several men have been employed temporarily during the year, mainly on special work in horticulture.

ACTIVITIES.

The work of the Branch has been carried on along the most economical and efficient manner possible. Orchard visits and inspections have been made as far as time and men would permit; orchard records made and reported on current year slips, and this data recorded on our five-year forms; this work was a follow-up on the records gathered during 1916. Many meetings were held and field demonstrations given in different fruit sections of the country. Judging of fruit and vegetables at fall fairs was carried out by our officials in nearly every instance; packing-schools, pruning-schools, and horticultural competitions were arranged and judged; demonstration spraying for the control of apple-scab, apple-tree anthracnose, peach-worm, etc., in co-operation with our Plant Pathologist, the Dominion Entomologist, and University Officials. Assistance was also given to other branches of the Department wherever possible in helping them carry out their work most effectively; inspection for codling-moth in area infested, banding and spraying for its control and eradication; inspection of foreign cars at points of assembly for codling-moth; inspection of and reporting on fruit for export; inspection of potatoes for outside points, and assistance to potato-shippers in proper loading of cars for shipment, etc.; inspection of nurseries; the collecting of fruit and vegetable crop estimates and figures in co-operation with the Statistics Branch of this Department; market-extension work, reporting on condition of markets and fruits and vegetables on arrival; the publishing of a weekly market bulletin at Vancouver and Calgary, giving wholesale and retail prices as well as f.o.b. prices from the main shipping centres, has also been a valuable feature in the work of this Branch. Visits were made to the principal fruit centres in Washington and Oregon by your Horticulturist and the Prairie Markets Commissioner. The Western Washington horticultural meeting at Seattle in February was attended by myself. E. W. White, W. T. Hunter, and myself attended the Western horticulturists' meeting at Corvallis, Oregon, in August, where an opportunity was afforded us of meeting the leading horticultural men from all the Western United States, and great benefits were derived from the splendid addresses there delivered.

CODLING-MOTH SITUATION.

Work has been carried on as usual in the control, and with hopes of eradication, of codling-moth at Westbank and Okanagan Landing as in past years. At Westbank spraying was continued this year in connection with banding the trees, and so far no worms have been found, which is very encouraging indeed.

The work should be continued next year in case of an oversight in inspection and the possibility of re-establishment. At Okanagan Landing the situation last year led us to believe that we had the infestation corralled in two orchards, and, following a very reasonable offer on the part of the owners of these two infested orchards, it was decided to buy the crop and pick and destroy same, to starve the worms if any were found. The banding of the trees was continued and several inspections made during the season, with clean results to report. Unfortunately, fresh infestations were discovered in some of the town-lot trees in Vernon shortly after our other work had commenced. Since then other infestations have been found in lots between Vernon and the Landing. A quarantine has been placed on all the adjoining orchards and the trees banded, and the fruit thoroughly inspected for worms. Owing to the limited area

infected the work of control and hopes of eradication are quite feasible, and this work must go on even though we have failed in our first attempt at its total eradication. The endeavour to keep this serious fruit pest out of our Province is of vital importance when we realize its ravages and enormous additional spraying costs to the growers where it has gained an entrance. It is estimated that it would cost our growers $5 for spraying per acre, and that at least three sprays would have to be applied in order to keep the worm under control. This would mean the great sum of $600,000 for spraying, basing our fruit acreage at 40,000 acres, besides the very considerable loss in fruit and the lowering of grades. It might be mentioned that the losses from the codling-worm in some of our leading fruit sections in the Western States to the south of us suffered losses this year up to 25 per cent. of their crop.

It is felt that the growers in the infested sections should be made to bear more of the expense and to realize the seriousness of the pest and work the Government is doing to help them. Strict supervision and consistent methods and endeavours must be continued if we hope to stamp it out of the Province.

Pear-blight.

The prevalence of this pest is greater in some sections this year than usual, and every effort will have to be made to compel, as usual, growers to thoroughly cut it out during the winter. Much educational work has been carried on by the Branch in past years, so that in the majority of the sections the growers are fairly familiar with the control methods and proper treatment.

Packing-schools.

Forty-four schools were held this year with a total attendance of 656 pupils, 287 of whom were junior class pupils. Many of these schools were held in the larger centres, where additional help in packing and harvesting was expected to come from. A great many of these pupils were women organized under the Y.W.C.A. Many of these pupils went into the fruit sections during the picking and packing season and did excellent work.

Pruning-schools.

There were only four of these schools held this year owing to the lack of suitable pupils, all the young men having left for the Front. These schools are very useful and will prove more popular—a great benefit in the districts in which they are held.

Horticultural Competitions.

Eight farm garden, four city garden, one strawberry, one tomato, and one onion competition were arranged for and judged by the officials of the Branch. These competitions proved very useful and instructive where a good keen competition was worked up. This work has been carried on for four years in many sections and still good interest is being exhibited. This feature of our activities worked well along with the increased-production work in the different cities and districts.

Publications.

It was realized that there was a great demand for a concise, brief, and practical circular dealing with horticultural subjects under British Columbia conditions, and a start has been made on a list of some fifty different subjects in a new horticultural series. Twenty of these have been issued so far.

Conclusion.

My report would be lacking were I not to mention the cheerful assistance rendered at all times by the officials of this Branch in carrying out the work of the Department to the best interests of all during the time your Horticulturist has been in charge, and the hearty co-operation and good-fellowship at all times exhibited by officials in other branches of the Department.

All of which is respectfully submitted.

M. S. Middleton,
Provincial Horticulturist and Inspector of Fruit Pests.

REPORT OF ASSISTANT HORTICULTURIST AND INSPECTOR OF FRUIT PESTS, OKANAGAN, SIMILKAMEEN, BOUNDARY, SALMON ARM, AND CANADIAN PACIFIC RAILWAY MAIN LINE DISTRICTS.

B. HOY, B.S.A.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—Below is a report of the work done by the Horticultural Branch in the Okanagan, Similkameen, Boundary, Salmon Arm, and Canadian Pacific Railway Main Line Districts for the year 1918.

CHANGES IN STAFF.

Last spring M. H. Chesbro, District Field Inspector for the Kelowna District, resigned and no new appointment was made. P. E. French, Assistant Horticulturist in charge of the North Okanagan and Salmon Arm District, resigned in April and this district was placed under the supervision of the writer in July.

LECTURES AND FALL FAIRS.

Lectures on horticultural subjects were given at Rutland, Glenmore, British Columbia Fruit-grower's Association annual convention at Victoria, Keremeos, Summerland, and Penticton. Fall fairs were attended in the capacity of judge of fruit and vegetables at Armstrong, Summerland, Kelowna, and Rock Creek. Separate reports of these fairs have been mailed to the Department.

The District Field Inspectors assisted the Department with fall fairs and with institutes throughout the district.

FIELD-CROP COMPETITIONS.

The following crop competitions were judged by members of the Horticultural Branch: Potato competitions at Grand Forks, Rock Creek, and Bridesville were judged by Mr. Hunter; farm-garden competitions at Enderby, Grindrod, and Mara and juvenile war-gardens competition at Oyama were judged by Mr. Evans; corn, onion, bean, and tomato competitions at Kelowna were judged by the writer.

PACKING-SCHOOLS.

The policy of holding packing-schools was again continued, and much time was spent by the members of the staff in arranging and organizing these schools in the various districts. The reports of these schools were sent in to the Department at Victoria by the various Instructors at the close of each school.

EXPERIMENTAL AND DEMONSTRATION.

Apple-scab.—The experiments on apple-scab were conducted on similar lines as the two previous years, with the exception that in the "materials" test at Salmon Arm "Sherwin Williams Dry Lime Sulphur" was added to the list of materials being tested. The results of these experiments have been very good and have demonstrated most emphatically that apple-scab can be successfully controlled at a very reasonable cost per acre. A separate report of detailed results has been mailed to the Department.

Aphis Experiments.—Experiments were conducted for the second time at Vernon on the control of green aphis. This work was started with the idea of finding a cheaper efficient spray. Black Leaf 40, 1 to 2,000 with 2 lb. of lime added to every 100 gallons of the mixture, is a much cheaper spray than those in general use, and in the tests made where this spray was used there was 90 per cent. mortality in the aphis.

Peach-worm.—The results of this experiment showed lime-sulphur at a strength of 1-7 applied when the peach-blossoms show pink in colour to be very effective in controlling this pest. The chief thing about this spray is to get it on at the time stated and do a thorough job, driving the spray into all the crotches.

Cover-crops.—Owing to the demand for information on fertilizing of orchards, cover-crop experiments were begun this year at Salmon Arm, Vernon, and Penticton. A small amount of seed of hairy vetch and sweet clover was bought and placed in the hands of some of the most reliable growers by the District Field Inspectors, who supervised the preparation of the ground

and planting. The Inspectors will advise the growers as to the proper methods of handling these cover-crops and keep a record of the results of the work. The time is not far distant when fruit-growers will need the best advice there is in this important phase of orcharding.

Lime Experiment.—To test out the value of lime in the Salmon Arm District on some of the acid soils, six plots were chosen of ½ acre in size on the different soil types. The lime has been applied to three of these and will be applied to the other three in the spring. This work is being done under the supervision of Mr. Barlow, District Inspector at Salmon Arm.

Inspection-work.

Car Inspection.—All foreign refrigerator-cars coming into the valley were inspected at Okanagan Landing for codling-moth. All sweepings from these cars were destroyed by burning. The same sort of inspection took place at Keremeos. One hundred and twenty-two cars were inspected at these two points and twenty larvæ were captured. This work is very important in keeping the country free of codling-moth, as this pest could be easily introduced from this source.

Nursery Inspection.—The Riverside Nursery at Grand Forks, the Kaleden Nursery at Kaleden, Stewart's Nursery at Kelowna, and Smith & Gorham's Nursery at Hullcar were inspected during the summer and the fall. Further inspection will be necessary during the shipping season in the spring at those nurseries where the trees are not taken up until spring.

Peach and Apricot Inspection.—A campaign against the peach-twig borer was started this spring in Summerland, Peachland, Penticton, and Kaleden. Spraying with lime-sulphur when the blossom-buds showed pink was insisted upon by your Inspectors in all peach and apricot orchards. Practically all growers gave their hearty support to this work, and only in the case of absentee ownership did we meet any obstacles. In these instances the orchards were either cut down or sprayed by the Department.

During the shipping season shipments of peaches and apricots were inspected so far as time would permit, with the result that the number of wormy peaches leaving the district was greatly minimized.

The results of the effort and time given to this work was very satisfactory. The good results from systematic spraying was very pronounced.

Codling-moth.—At Walhachin, Vernon, and Westbank the Department has orchards under quarantine for codling-moth. The same policy that was adopted in 1916 was carried through this year in the Westbank work. Two sprays of arsenate of lead were applied, the calyx spray commencing May 20th and the second spray commencing June 20th. Twelve thousand trees were banded and the bands inspected five times during the season. On the third inspection, which commenced on August 6th, three worms were found. Two more inspections followed this, but no signs of the pest were found. Sixteen thousand boxes of apples and 1,200 boxes of pears were shipped from this district and no worms were found in the fruit. The results of the year's work at Westbank is very gratifying, as the following figures show: In 1916, 340 worms were found; in 1917, 58; and in 1918, 3. While no worms were found in the last two band inspections, it is hardly safe to assume that the pest is entirely eradicated, and it would be well to continue the work another season.

The same policy as previously followed by P. E. French was followed through the season at Walhachin. The results here are such that warrant us to assume that codling-moth has been eradicated from this area. No worms were found in either the fruit or bands.

At Vernon the policy adopted in 1916 was, on the recommendation of P. E. French and R. C. Treherne, Dominion Entomologist for British Columbia, changed this spring, and instead of spraying and banding the area under quarantine the apples of about 50 acres were purchased by the Government and picked before maturity and destroyed. Band inspections continued throughout the summer, and in the last three band inspections no worms were found, which warrants us in assuming this area to be free of the pest. While this portion is apparently free of worms, infection has been found in neighbouring orchards. In October worms were found in four properties about one mile north of the quarantined area. These four places aggregate about 15 acres. Quarantine measures were immediately adopted on all of theses places.

A new outbreak was discovered in the town of Vernon this spring and three places were quarantined. Thirteen worms were taken from this area during the summer.

Codling-moth is still a great menace to the orchards in the Vernon District, and stringent quarantine and control-work will be necessary this coming season to prevent this pest from making further headway.

Fire-blight.—A very great deal of your Inspector's time is taken up in the control of this disease. This year no great amount of damage was done, except in the Kelowna District, where the disease was more prevalent than in any previous year. Your Inspectors have pointed out to all growers the very serious nature of this disease and the urgent need of cutting it out thoroughly. They have also endeavoured to locate all infected orchards. As the control of this disease is a community problem and depends entirely on each man thoroughly cutting out the diseased portions of his trees, all Inspectors are instructed to keep in touch with the work being done in blight-infected orchards, and where necessary to take effective steps to see that the work is done.

San Jose Scale.—The control-work done on this pest at Spences Bridge has apparently eradicated it from the orchards, but the scale was found on wild growth near the orchards this spring. This growth was grubbed out and burned, with the result that no traces of the insect were found this fall. It is not safe to assume from this that the scale is eradicated, so this work will be followed up closely by close inspection and thorough spraying by the growers.

Woolly Aphis.—This pest is on the increase and is difficult to combat. In 1917 a small experiment was conducted at Kelowna with various sprays to combat this pest. This year a more extensive experiment was carried out under the supervision of R. C. Treherne to find out the best means of combating this pest.

Wireworms.—These worms were very much in evidence this year and did considerable damage in onion and potato fields. Extensive study of the habits of this pest and means of control was carried on by Mr. Treherne during the summer.

Grasshoppers.—Grasshoppers were not as plentiful this year as in 1917. As a result of the demonstration in the control of this pest conducted by the Department in 1917 nearly all growers were prepared to combat this pest.

Onion-thrip.—Many crops of onions were materially reduced by the ravages of this insect. A few growers attempted spraying, but it was only done in a very crude way and the results were not very satisfactory. Preparations are being made now by some of the growers to combat this pest in a thorough manner next year.

Onion-maggot.—More onion-fields were attacked by this pest than in any previous year. Some demonstration-work on methods of control was carried on by the Entomological Branch, but was not started early enough to get the desired results.

Pea-weevil.—This year pea-weevil was found in Kelowna and Summerland. This pest has apparently gained entrance to the valley by growers bringing in small amounts of seed from the Prairie. All infected material found has been treated in such a manner as to kill all insects.

Export Fruit and Vegetables.—The shipments of fruit and vegetables was not, owing to the embargo put into effect in Great Britain and Australia in the early part of the season, as large as in some previous years. Considerable attention during the shipping season is given to the inspection and issuing of certificates for this fruit. Practically no potatoes were exported from this district this year. A few hundred pounds were sent to China and one car to the United States.

STATISTICAL WORK.

Crop estimates were made in the spring by your Inspectors and mailed to the Department. Figures on the tonnage of fruit and vegetables shipped out and handled by the canneries and evaporators have been collected and forwarded to the Department.

GENERAL WORK OF BRANCH.

The same general policy as followed in previous years was carried out this year. Your Inspectors have at all times been at the service of the growers, and a very large portion of their time has been devoted to helping them solve various problems confronting them. This work is done by consultation in the office, by telephone, mail, and by personal visits, where things are talked over in the field. This kind of work, though absorbing a great deal of time, is very much appreciated.

During the shipping season the Inspectors are called upon by the shippers and growers to advise *re* shipments and various diseases and pests.

Respectfully submitted.

BEN HOY,
Assistant Horticulturist and Inspector of Fruit Pests.

CODLING-MOTH CONTROL IN VERNON AND OKANAGAN LANDING DISTRICTS, 1918.

Dates and Material taken on Fruit- and Band-inspection Work in Various Orchards.

G. Mickleborough, about 35 Acres.—Band inspections: First, July 15th to 22nd, 4 larvæ, 5 pupæ; second, July 27th to August 3rd, 1 larva, no pupæ; third, August 14th to 18, no larvæ, 2 pupæ; 4th, August 28th to September 4th, none; fifth, September 27th to October 3rd, none; sixth, November 13th to 16th, none. Totals, 5 larvæ, 7 pupæ.

J. Mutrie, about 15 Acres.—Captured in apples between June 22nd and August 9th, 90 larvæ; over-wintering material captured May 10th to 21st, 2 larvæ, 6 pupæ. Totals, 92 larvæ, 6 pupæ.

The above are records on the area on which fruit was bought and destroyed before maturity.

J. Mutrie, about 25 Acres.—Band inspections: First, August 15th to 20th, none; second, September 10th to 15th, none; third, November 8th to 13th, 4 larvæ. Captured in apples between October 24th and 29th, 3 larvæ. Total, 7 larvæ. Nothing was found in the above during 1917 or previous to October 19th, 1918.

J. Wylie, about 15 Acres.—Band inspections: First, August 15th to 20th, none; second, September 10th to 15th, none; third, October 19th to November 12th, 34 larvæ. Captured in apples between October 30th and November 5th, 5 larvæ. Total, 39 larvæ. Nothing was found in the above during 1917 or previous to October 19th, 1918.

In the Vernon Town outbreak, comprising about 2 acres on four different properties, 3 band and fruit inspections resulted in the capture of 7 larvæ and 6 pupæ. Lot-owners: J. Blunden, L. O. Bunville, Mrs. Wright, and Mr. Boyd.

A new infestation was located on October 11th, 1918, at Okanagan Landing on an area totalling about 17 acres on four different properties. No banding was done, but all shipping fruit was inspected, all worm-marked apples and windfalls being destroyed. Owing to shortage of labour and pressure of work at this time, it was not possible to make actual count of captures, but it can be safely assumed that all of 200 worms were destroyed. Owners of the above lots are: Mrs. C. O'Keefe, 6 acres; R. Swift, 6 acres; T. Flemming, 2 acres; T. S. McClennan, 3 acres.

REPORT OF ASSISTANT HORTICULTURIST AND INSPECTOR OF FRUIT PESTS, VANCOUVER ISLAND AND LOWER MAINLAND DISTRICTS.

E. W. White, B.S.A.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

Sir,—Owing to the fact that at the present time there is no Provincial Horticulturist, I beg to submit herewith to you my annual report as Assistant Horticulturist and Inspector of Fruit Pests for Vancouver Island and the Lower Mainland for the year 1918.

Orchard-renovation Work in the Fraser Valley.

During the last days of 1917 a most severe ice-storm visited the Fraser Valley and caused a great deal of damage to orchards, small-fruit plantations, native and ornamental trees, telephone, telegraph, and electrical wires. The area affected extended roughly from Langley Prairie to Rosedale on the south side of the Fraser River and from Agassiz to Ruskin on the north side of the river.

Peculiar atmospheric conditions were responsible for the storm. On December 24th and 25th the weather was bright and clear and somewhat frosty. On December 26th rain began to fall into a ground temperature of 4 to 8 degrees of frost, which of necessity caused the rain to freeze where it fell. Ordinarily this precipitation should have fallen as snow, but owing to a very strong Chinook west wind that was blowing in the upper atmospheric regions it was not congealed and consequently fell as rain. As evidence that this Chinook wind was blowing, it may be stated that before the storm the mountains in the Chilliwack District, from Mount Cheam west, were all covered with their winter fall of snow, and after the storm subsided there was practically no snow to be seen on the mountains surrounding the valley. The rain continued to fall and freeze for three days, and when the storm subsided on December 30th it was estimated that there was practically 8 inches of solid ice on the ground.

Your assistant paid a visit to the Chilliwack District on January 3rd, going in on one of the first Canadian Northern Railway trains to get through. A preliminary survey was made of the damage done and a report submitted on January 15th.

During the first week of February another visit was paid to the district in company with M. S. Middleton, Provincial Horticulturist, and a decision was reached as to the manner in which the Government, through its Horticultural Branch, could be of the greatest assistance to the owners of orchards. It was decided that a force of expert pruners under the direction of your assistant should be employed, who would visit each individual grower and advise him as to which course was the wisest for him to pursue.

The weather was so unsettled during the early part of the year that it was impossible to start work until the first week in March. The following men were then employed: C. R. Barlow, District Fruit Inspector for the Salmon Arm District, was loaned for the work from March 4th to March 19th; K. W. Munson, of Vancouver, and late of the Rogue River Valley, Oregon, a practical horticulturist, was engaged on March 6th and continued throughout the spring, and later carried out the duties of District Field Inspector for the Fraser Valley; A. Smith, of New Westminster, a practical horticulturist, was employed from March 18th to March 30th. These men were employed chiefly in the Chilliwack section. T. H. Bain, of Vancouver, at various times attached to the Provincial Department of Agriculture and the Dominion Fruit Inspector's office, was employed in the Mission-Hatzic District from March 21st to May 23rd. The work that these men were able to accomplish was greatly appreciated by all those concerned, and consisted chiefly of a personal visit to each grower, enough time being given to actually advise him which trees could be repaired and which should be removed; methods of pruning, wiring, and bolting split trees; methods of top-working and grafting and the best varieties to use. These men did not simply look on and give advice, but actually got in and did the work themselves, a condition being, however, that the grower himself had to be on the spot to help and give all assistance possible.

Demonstrations in grafting were held later in the spring, and the work accomplished was very successful. In one orchard in Chilliwack Mr. Munson set over 2,500 grafts, all of which took, with the exception of about fifty.

SMALL-FRUIT PLOT, CHILLIWACK.

This demonstration small-fruit plot was planted out under the supervision of the Horticultural Branch in 1912, and remained under its control until April, 1917, when the lease expired. In 1917 it was managed by the owner, A. Johnson. In 1918 K. W. Munson, who was employed by the day by the Horticultural Branch as District Field Inspector, was given permission to rent this plot and to handle it for his own benefit, taking such time off, without remuneration, as was necessary for the proper management of the undertaking. For this privilege Mr. Munson agreed to furnish the Horticultural Branch with a complete report at the conclusion of the year. This report was furnished and appeared in full in the December issue of the *Agricultural Journal*.

While the venture proved a financial success to Mr. Munson, still it was really a patriotic impulse and a desire to prove his unbounded faith in the suitability of the district for the production of small fruits that prompted Mr. Munson to undertake the management of the plot. Despite the fact that the very high rental of $112.50 per acre was paid, 2 acres of Evergreen blackberries returned $1,323.15 net, ¼ acre of loganberries returned $100.74 net, ¾ acre of raspberries returned $191.45 net, and ½ acre of Snyder blackberries showed a loss of $1.27 net. This should demonstrate conclusively that the right varieties of small fruits, planted in the proper location, will prove very profitable under proper management.

CONCLUSION OF THE PEAR-THRIPS WORK IN SAANICH.

This work, which was instituted in 1916, following the severe outbreak of pear-thrips in 1915, and which was continued in 1917, was practically completed in 1918.

In the spring of 1918 a complete bulletin on the subject, prepared by R. C. Treherne and Dr. A. E. Cameron, Field Officers of the Dominion Entomological Branch, was published by the Dominion Department of Agriculture. During the spring and summer further notes on the life-history were kept by W. Downes, assistant to Mr. Treherne in this district.

The operations of the Horticultural Branch were limited. Of the three power-sprayers in use in 1916 and 1917, the one located at Royal Oak was sold to T. A. Brydon & Sons, who undertook all their own spraying. The Gordon Head sprayer was moved to town and completely

overhauled, and later removed to Keating, where it was placed at the disposal of a number of the growers. This movement was necessary because the Keating machine broke down and it was necessary to bring it to Victoria for overhauling, after which it was stored in anticipation of any emergency.

The pear-thrips, while they appeared in very considerable numbers, were not as serious as in 1915-16-17, and were held in check where the recommended sprays were used.

Meetings, Press Articles, and Department Publications.

During the spring several meetings were addressed, principally on the subject of gardening. Various articles were prepared during the year for the agricultural press and the Department's *Agricultural Journal*. In April Circular Bulletin No. 6, "Gardening on a City Lot," was revised and issued as Circular No. 43, "Gardening on a City Lot," of the new horticultural series. Circulars on the various small fruits are in course of preparation at the present time.

Horticultural Competitions.

During the summer your assistant was called upon to judge all the competitions held in this district. Keen interest was displayed in all the competitions, and it is believed that they do a great deal towards stimulating greater activity in the lines for which they are held.

The following is a list of the competitions judged by your assistant and the number of entries in each:—

Place.	Competition.	No. of Entries.
Victoria	Home garden (Class A)	23
"	Vacant-lot garden (Class B)	30
"	Professional garden (Class C)	11
"	Children's garden (Class D)	3
Ward IV., Saanich	Cottage garden	23
Ward VII., Saanich	"	15
Metchosin	Farm garden	10
Gordon Head	Strawberry	10
Coquitlam	Farm garden	10

Fall Fairs.

The following fall fairs were attended by your assistant in the capacity of judge of fruit and vegetables. At some of the fairs K. W. Munson assisted with the judging. The fairs attended were as follows: Central Park, Mission City, Agassiz, Maple Ridge, Langley, Aldergrove, Coquitlam, Burquitlam, Surrey, and Matsqui.

R. C. Abbott and K. W. Munson judged the Chilliwack Fair, and Mr. Abbott also judged the fruit at Aldergrove.

At the Vancouver Fair the Horticultural Branch conducted demonstrations in grafting and budding in connection with the Department's information booth. Specimens were shown illustrating the results of our work in the Fraser Valley last spring following the severe ice-storm. K. W. Munson conducted the majority of the demonstrations, which were largely attended.

At the Chilliwack Fair Mr. Munson put on a practical demonstration in box-making and fruit-packing, which was much appreciated by the fruit-growers who attended, and much valuable information was disseminated.

At the Home Products Fair in Victoria Mr. Munson again demonstrated grafting and budding at the Department's information booth, and a large number of city people were keenly interested.

Your assistant also attended the North and South Saanich Fairs, and assisted Professor F. M. Clement with the judging of the district exhibits. A complete report on the fairs has been submitted.

Experimental Spraying.

(1.) *Keating.—Re* control of black-spot canker or anthracnose. The two applications of Bordeaux mixture were again applied to the experimental block at Keating. This completes the third year's spraying, and as soon as the counts are made in the spring of 1919 by J. W. Eastham, Plant Pathologist, a complete report on the three years' work will be available.

It has been demonstrated, however, that an early application in September of a weak Bordeaux mixture (3-4-40) to late varieties of apples while the fruit is still on the tree is feasible, and that it will control black-spot canker almost completely. A late spray of (6-6-40) Bordeaux applied to the same varieties after the fruit is picked and after the fall rains have commenced is almost useless.

(2.) *Chilliwack.—Re* control of the flea-beetle on turnips. In the early summer of 1918 a very severe infestation of flea-beetle occurred on turnips in the Chilliwack District. The Horticultural Branch enlisted the co-operation of the Soil and Crop Division, in that one of the recently purchased potato-sprayers was loaned, and K. W. Munson conducted some experiments in an endeavour to control the flea-beetle. However, by the time the sprayer was available two early plantings of turnips had been destroyed. The experiments were not altogether satisfactory owing to the late date and the extremely dry weather. The third planting of seed took from two to three weeks to germinate, and the plants were weak when they appeared above ground. Five plots were sprayed once, two plots twice, and one three times.

From the results that were evident, Mr. Munson is confident that the spray formula used—namely, Bordeaux mixture (4-5-40) plus arsenate of lead 6 lb. to 100 gallons—will control the flea-beetle if the turnips are planted early and kept covered with the spray during the first part of the season.

Inspection of Nurseries.

This work was carried out according to the regulations in so far as it was possible. Inspections were made at all the principal nurseries at digging-time and again at shipping-time. There are only two main producing nurseries in operation at the present time—namely, the Layritz Nurseries, Victoria, and the British Columbia Nurseries at Sardis.

There has been a greatly increased demand for nursery stock during 1918, and the probabilities are that the stocks on hand will be completely sold out by the spring of 1919.

Insect Pests and Diseases.

In many ways the season has been very favourable as regards fruit pests. The strawberry-root weevil has again caused very considerable loss to the strawberry-growers of Gordon Head and Keating. W. Downes, of the Dominion Entomological Branch, stationed in Victoria, has continued his studies on the life-history of the insect and has obtained some valuable information. We feel confident that if the growers will adopt our recommendations they will be able to hold the weevil in check, so that profitable crops may be produced.

No work was undertaken in regard to the black-currant bud-mite infection in the Duncan District, nor the codling-moth infection in the Victoria District, both infections having been practically eradicated.

Tent-caterpillars were a very serious pest in uncared-for orchards and in waste places. This pest can be easily controlled if proper preventive measures are used. Other common insects were of about the same severity and did not cause undue damage.

Late blight was again serious on the Lower Mainland, and spraying for this disease became general. An incentive to this work was given this year by the Soil and Crop Division, who operated several potato-plots. The results from spraying were very marked.

Apple-scab was less prevalent this year than for a number of years, it being a very favourable year for the production of clean fruit. The dry weather during April, May, and June was unfavourable for the development of scab.

Other diseases were of about normal severity and did not cause undue damage where proper remedial measures were adopted.

Fruit and Vegetable Production.

Climatic conditions were again more or less unusual and were not conducive to maximum crops. April was characterized by having more than normal sunshine, frequent cold nights, average temperature, drying winds, and unusually light rainfalls. The precipitation was the lightest for a number of years. The month of May was cold and windy, with a notable deficiency in both sunshine and rainfall. As a consequence of the cold nights, lack of adequate sunshine and moisture, the growth of all vegetation was slow and unsatisfactory. June was very hot and dry, with practically no precipitation. The growth of all crops was retarded by the lack of moisture and the dry, hot winds.

These three unusual months were extremely trying on the strawberry-crop in Gordon Head and Keating, and resulted in a somewhat reduced crop. The shipments for 1918 were fifteen cars or approximately 12,000 crates, while nearly 200 tons of berries were disposed of to the jam-factories. Prices were extremely good, and prospects are that they will be very much better in 1919.

Tree-fruits were an average crop, some varieties being off-bearing. Olivet cherries were an excellent crop and again brought good prices. Vegetable-crops looked poor during the summer, but picked up remarkably well during the fall months.

On the Lower Mainland the raspberry-growers had a very successful season and prices were good. Practically the total shipments to the Prairies were made L.C.L. A portion of the crop was lost, due to wet weather and the ravages of the mosquito pest. Blackberries were a poor crop in the Mission-Hatzic District, but at Chilliwack they did exceptionally well.

Apples were light owing to the damage done by the ice-storm, but the quality and cleanliness were much superior to former years. Pears and cherries, however, were extremely heavy, but prunes were almost a total failure. While the year was unfavourable, vegetable production showed an increase over the previous year.

Fruit and Vegetable Crop Statistics.

A god deal of time is required in the fall months to gather the fruit and vegetable statistics for A. B. Tweddle, Statistician. Reports on manufactured products are also secured from all the canneries, jam-factories, and evaporators.

Demonstrations and General Work.

A large number of demonstrations in the various branches of horticultural science have again been given in all parts of the district this year. As a matter of fact, a number of personal calls have had to be omitted owing to the lack of time. This line of work takes up an increasing amount of time, but is very valuable and much appreciated by the growers.

Visits to Washington and Oregon.

During the first week of July your assistant had very great pleasure in accompanying M. S. Middleton, Provincial Horticulturist, on a trip of inspection to the commercial raspberry and blackberry sections of Puyallup and Sumner, Washington. The Western Washington Experimental Station at Puyallup was also visited. A great deal of valuable information regarding small fruits was secured, which was of great assistance in meeting the problems of our own small-fruit growers.

During the first two weeks of August your assistant again accompanied Mr. Middleton to Corvallis, Oregon, where the first annual meeting of Western horticulturists was held at the Oregon Agricultural College. Representatives were present from the Western States of Washington, Oregon, California, Idaho, Montana, and from the Province of British Columbia. An exceedingly valuable three-day convention was held, as practically all the leaders of Western horticulture were present.

The great loganberry district of Salem, Oregon, was also visited. On the return trip occasion was taken to visit the cranberry-bogs of Long Beach and Ilwaco, Washington. A great deal of valuable information was secured on this trip to Washington and Oregon.

Correspondence and Office-work.

This work has taken up an increasing amount of time, especially since November 16th, when M. S. Middleton resigned his position as Provincial Horticulturist and Inspector of Fruit Pests. No appointment being made to fill the position, the work of the office has of necessity fallen upon your assistant.

All of which is respectfully submitted.

E. W. White,
Assistant Horticulturist and Inspector of Fruit Pests.

REPORT OF ASSISTANT HORTICULTURIST AND INSPECTOR OF FRUIT PESTS, EAST AND WEST KOOTENAY DISTRICTS.

E. C. HUNT, B.S.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—I beg to submit herewith my annual report as Assistant Horticulturist and Inspector of Fruit Pests on the work in the above districts for the year 1918.

PACKING AND PRUNING SCHOOLS.

During the early part of the year fruit-packing and pruning schools were organized. Packing-schools were held at the following places: One each at Nelson, Harrop, Creston, and Kaslo, and two at Nakusp. Four of these schools were held for the boys and girls attending the public and high schools.

The demand for pruning-schools was not so great this year as in the past, on account of so many of the fruit-growers and orchard-helpers of the district having now been pupils of these schools. However, three schools were conducted—one each at Creston, Wynndel, and Robson—for the boys and girls of the high schools.

As a whole, all the schools were well attended and a great deal of interest shown by the pupils taking part. A full report on each school was sent in to the Department at the time the schools were held.

HORTICULTURAL COMPETITIONS.

In 1918 there were held in this district by the Department six horticultural competitions of various kinds. These competitions were judged from two to three times during the season. The greater portion of the time during July and August was spent on this work. The details of the scores in connection with these competitions have been submitted. Keen interest was taken in all the competitions, and some of the gardens were a credit to any district and showed that great pains had been taken in their preparation and care.

The following is a list of the competitions judged and the number of entries in each:—

Place.	Kind of Competition.	Number of Entries.
Nelson	City garden	18
"	War garden	8
Natal	City garden	22
Shirley	Farm garden	11
Willow Point	"	13
Baynes Lake	"	10
Thrums and Shoreacres	"	12

Other competitions judged during the year were the potato and mangel competitions conducted in this district by the Soil and Crop Division. These were held by the Farmers' Institutes at the following places: Cranbrook, Newgate, Crawford Bay, Edgewood, and Thrums-Shoreacres. Scores and report of each have been submitted.

EXPERIMENTAL WORK.

The experimental work conducted this year included principally spraying experiments for the control of apple-scab. These experiments were duplicates of those carried on in 1916 and 1917 at Nelson, Creston, and Edgewood, the third and last year of the three-year test-plots for scab-control with the different strengths of lime-sulphur. The results obtained this year were, on the whole, very successful, as may be seen from the following summary of the experiments:—

Experiments conducted on the same plots and trees as in 1916 and 1917. All trees of full bearing age. Variety, McIntosh Red.

Table of Plots and Sprays (L.S. = Lime-sulphur).

Time of Spray.	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 5.	Plot 6.	Plot 7.
Delayed dormant	L.S. 1-25	L.S. 1-25	.....	.....	.....	.....	Check.
Pink	L.S. 1-30	.....	L.S. 1-30	L.S. 1-30	L.S. 1-30	L.S. 1-30	"
Calyx	L.S. 1-35	L.S. 1-35	L.S. 1-35	L.S. 1-35	L.S. 1-35	L.S. 1-35	"
14 days later	L.S. 1-35	L.S. 1-35	L.S. 1-35	L.S. 1-35	.....	.....	"
14 days later	L.S. 1-35	L.S. 1-35	L.S. 1-35	.....	.....	L.S. 1-35	"

The following table gives the results of the fruit-counts made on the McIntosh Red at Nelson, Creston, and Edgewood. In making the counts, all apples on one uniform tree in each plot were carefully examined and notes taken on the scab.

Plot.	No. of Apples counted.	Fruit free from Scab.	Scabby Fruit.	Culls on Account of Scab.	Total Marketable Fruit.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.
Nelson					
1	106	93.4	6.6	None	100.0
2	100	35.0	65.0	"	100.0
3	137	54.7	45.3	"	100.0
4	106	52.5	47.5	"	100.0
5	117	17.0	83.0	2.5	97.5
6	123	64.3	35.7	None	100.0
7, check	136	None	100.0	47.5	52.5
Creston—					
1	552	99.8	0.2	None	100.0
2	1,021	99.9	0.1	"	100.0
3	1,458	99.9	0.1	"	100.0
4	1,831	99.4	0.6	"	100.0
5	1,558	99.3	0.7	"	100.0
6	983	99.5	0.5	"	100.0
7, check	1,037	70.3	29.7	12.0	88.0
Edgewood—					
1	1,267	94.0	6.0	0.2	99.8
2	476	99.5	0.5	None	100.0
3	224	96.8	3.2	"	100.0
4	934	88.0	12.0	0.5	99.5
5	737	39.6	60.4	0.8	99.2
6	401	81.3	18.7	0.8	99.2
7, check	210	7.6	92.4	17.6	82.4

From these results it can be easily seen that fruit can be produced commercially free from scab, even the most susceptible varieties, by the application of lime-sulphur at the above strengths. The number of sprays to be applied will depend a great deal on the season. From the above results it would seem that three sprayings—pink, calyx, and one later—thoroughly applied would control scab in any normal season. A full report, giving in detail the work done and results obtained from the experiments, has been submitted to J. W. Eastham, Provincial Plant Pathologist.

Dust-spraying with sulphur for the control of apple-scab was carried on at Willow Point for the first time this year; this experiment being in charge of Professor F. M. Clement, of the University of British Columbia. Four applications of the sulphur were applied to the trees during the scab-infection season; assistance being rendered to Mr. Clement from time to time with this work.

Demonstration of Cover-crops.

With the view of keeping up and improving the fertility of orchard soils, a few demonstrations of cover-crops were started this fall. These demonstrations are being carried on at Sunshine Bay, Willow Point, and Birchbank. Spring (common) vetch and fall rye are the cover-crops that are now being tried out. A mixture of vetch and rye was sown at Birchbank and Willow Point, while at Sunshine Bay vetch alone was sown. These crops have done as

well as could be expected. Data is being kept on their adaptability, cost, and their qualities as a soil-builder. Winter-vetch seed could not be secured or some demonstration of cover-crops with it would have been started also.

DEMONSTRATION AND EXPERIMENTAL ORCHARDS.

A certain amount of supervision to the orchards at Birchlands, Waldo, Wardner, and Rossland was continued in 1918. These orchards were pruned in the spring and a considerable replanting was done in the Waldo and Wardner orchards; all the injured trees were replaced by the Department with suitable hardier varieties, and the orchards turned over to the owner in as good a state as possible; the five-year agreement between the owner and the Government having now terminated. The replaced trees ordered for the Rossland orchard did not arrive last spring, so it will be necessary to make the replacements in the spring of 1919 before this orchard is turned over to the owner.

FALL FAIRS.

In September and October fall fairs were attended in the capacity of judge of fruit and vegetables at the following places: Fruitvale, Trail, Nelson, Natal, Creston, and Cranbrook. A separate report on each fair with a marked prize-list has been submitted.

SURVEY-WORK.

During the winter months and at times when the weather was unfavourable for field-work, your assistant was compiling data from the orchard-survey reports that were collected in 1916. This work will be completed by the end of this year, and from these records considerable useful information can be had on the different orchards in the district.

DISEASES AND INSECT PESTS.

Apple-scab.—This disease was not so prevalent in 1918 as in previous years. A very late scab-infection, however, occurred this year on some of the most susceptible varieties. This was due to the wet and muggy weather in August, which is unusual for this district. The results that have been obtained from the scab experiments conducted in the district for the past two years have convinced many growers who had become discouraged that scab was a controllable disease. As a consequence, where growers have adopted proper spray measures in the control of scab (which is now quite general throughout the district) a high percentage of clean fruit has been produced.

Fire-blight.—This very serious disease was found in only one place in the Kootenay District in 1918; it showing up in six different orchard lots in the City of Nelson. All the infections were confined to pear-trees—about twenty trees in all affected. The different infections are well under control and located, so that the hold-over cankers can be easily cleaned up during the dormant season.

Oyster-shell Scale.—This insect is found to be quite bad in some of the old and neglected orchards at different points within the district. The insect has not become a serious pest in the well-managed orchards and can quite easily be controlled by spray measures recommended by the Department.

Cutworms.—Cutworms have been a very serious pest in most all sections of the district. They occurred in great numbers, causing a great deal of trouble and damage to the growers of garden-truck and field-crops.

Potato-diseases.—Potato-diseases are on the increase, the most common ones being common scab, late blight, *Rhizoctonia*, and *Fusarium* wilt. These will require careful attention in the future in the way of longer rotations of crops, the planting of better seed, and the adopting of seed-treatment and seed-selection methods that have been recommended by the Department.

Other Insect Pests and Diseases.—The following other insects and diseases that caused more or less trouble and in some cases considerable damage to the fruit and vegetable crops might be mentioned: Green aphis, cabbage and onion maggots, cabbage-worms, pear-leaf blister-mite, peach-leaf curl, apple anthracnose, and many other minor ones.

All of the above insect pests and diseases were attended to as far as possible by making personal calls on growers and giving advice and information on the methods of control and eradication.

Orchard Visits and Demonstrations.

Personal visits to many different orchards of the district were made during the year; many requests coming in from growers for demonstrations and advice on various horticultural subjects. This line of work takes up a great deal of time and is much appreciated by the growers.

Crop Reports.

Crop estimates and reports are furnished from time to time during the growing season, and at the end of the year a detailed report is made of the total production of all fruits and vegetables in the district. Information and data is also collected in a similar way from the jam-factories of the district.

Office-work.

Office duties, although on the increase, were much the same as in previous years. The necessary correspondence and other duties were attended to.

All of which is respectfully submitted.

E. C. Hunt,
Assistant Horticulturist and Inspector of Fruit Pests.

REPORT OF DISTRICT FIELD INSPECTOR, LOWER MAINLAND DISTRICT.

K. W. Munson.

E. W. White, Esq.,
Assistant Horticulturist, Department of Agriculture, Victoria, B.C.

Sir,—I beg to submit herewith my annual report as District Field Inspector for the Lower Mainland District for the year 1918.

Pruning.

The severe ice-storm in the Chilliwack District in the month of January, 1918, was unprecedented in the history of that section. Cottonwood, fir, and cedar trees were nearly stripped of limbs, leaving only rugged appearing spars throughout the valley and foot-hill area. Fruit-trees were bent and broken to the ground by tons of ice. Trees of the open-centred (vase-shaped) type were in most cases split through the trunks to the ground. Those of the modified-leader and central-leader type, however, were not severely damaged.

About March 1st the Horticultural Department thought it necessary to assist the fruitmen and owners of family orchards in this section in reclaiming the trees, which many owners were inclined to take out by the roots. Mr. Barlow, of Salmon Arm, A. Smith, of New Westminster, and your Field Inspector were employed to assist with the work under your supervision.

On March 6th to 9th a general survey was taken of conditions and a plan outlined of the work to be done. From March 9th to April 4th this crew of men visited the majority of fruit-growers and farmers of this section. An hour or two was spent with some, and as much as three days of practical pruning and instruction given to others. The time spent in this practical and instructive work was determined by the number of trees owned by the individual. The commercial-fruit men were given more assistance in order to encourage the continuation of the industry. Each benefactor was told of the pruning, spraying, and thinning methods in vogue in the large commercial-fruit districts. A spirit of friendliness was shown us, with very few exceptions, and our instruction accepted with welcome.

A. Arnold, Sardis; P. W. Cronkshaw, Sardis; J. Higginson, Sardis; J. Orr, Chilliwack; W. Hodgins, Chilliwack; and many others were the fruit-growers given from ten to fifty pruning-hours each. Several hundred farmers with family orchards were also benefited.

The crew of four pruners at times worked together, and at times separately in different sections. The grower in either case was always asked to be on the job to hear the whys and hows of the demonstration.

Hundreds of seemingly impossible trees to save were brought back into shape with block and tackle, bolted and cross-bolted through the trunk, double cross-wired across the top, using telephone-wire and screw-eyes, and severely pruned back to eliminate side sway and saved to make sturdy trees.

The work of the ice-storm and crew of pruners did unlimited good in showing the farmer and fruit-grower the advantage of keeping the trees well open to sunlight to make clean, profitable fruit.

GRAFTING.

Many undesirable varieties of apple and pear trees were sold into this district untrue to name previous to the "Bonding of Nurserymen Act."

The ice-storm having reduced the fruit-bearing capacity of many fine trees down to nothing, made the spring of 1918 an ideal time to top-graft these undesirable varieties to apples commercially adapted to this district.

A notice was placed in the local Chilliwack paper offering assistance and instruction. Practically the same territory was covered, demonstrating grafting as in pruning. Mr. Stringer's 5-acre orchard of some 300 trees (apple and pear) were top-worked to Yellow Transparent, Devonshire Quarrenden, York Imperial, and Bartlett pears.

About 2,500 scions were set in this block alone, with a loss of less than 2 per cent. The grafts in this block made an average growth of 40 inches during the past growing season. Three seasons more and the trees will be as large as before wrecked by the storm.

Intermingled with the grafting-work, and following it, assistance and instruction was given in the three sprays for apple-scab.

CROP REPORT.

To acquire a complete crop report it was necessary to canvass the entire district, visiting not only the fruit-growers, but farmers with gardens and family orchards. An estimate as near as was possible was made of the individual production for 1917, as well as 1918, as well as the number and kinds of fruit-trees planted.

FLEA-BEETLE EXPERIMENTS.

In the summer of 1918 a large percentage of the field turnips were destroyed by the flea-beetle. Very late in the spring of 1918, after two early plantings of turnips had been destroyed by the flea-beetle, we started a series of experiments. Owing to the late date and the extremely dry weather throughout the summer the experiments were not entirely satisfactory. The turnip-seed took two to three weeks to germinate, and after seed-leaves broke through the ground the plant had no vitality to resist even a small percentage of damage by the flea. Five plots were sprayed once, two plots twice, and one plot three times.

From results that were evident, the spray formula, Bordeaux 4-5-40 plus arsenate of lead 6-100, the writer thinks will give satisfactory results if the turnips are planted early.

The first spray should be applied with good pressure when the seed-leaves are breaking through the ground, eight to ten days intervening between each of the second and third sprays.

PRACTICAL DEMONSTRATIONS.

The writer made practical demonstrations in budding and grafting at the Vancouver Fair, August 22nd, 23rd, and 24th, and at the Victoria Industrial Fair, October 4th and 5th. The interest shown by the public gave ample proof that practical demonstrations in all the industrial agricultural branches should be carried on by the Department each year at all the larger fairs in city or community.

A fruit-handling demonstration was held in a large tent at the Chilliwack Fair, September 18th, 19th, 20th, and 21st. Practical, modern methods of packing, box-making, picking, etc., were shown to the keen interest of the public.

JUDGING FAIRS.

Judging of fruits and vegetables was carried on at ten of the Lower Mainland agricultural fairs. The exhibits at these fairs were good, but from an educational standpoint there is room for betterment; also lack of co-operation between smaller districts was evident. In many sections small, out-of-class fairs could be combined with a neighbouring community, and one good, well-attended fair could be a success educationally, industrially, and financially.

The exhibits of commercial packed fruits, especially apples, were small in number and poorly packed. With few exceptions the antiquated square pack was used. It is advisable that not only exhibitors of packed apples and pears for next year's fairs, but also commercial growers write the Department of Agriculture for pamphlet on "How to pack Apples and Pears."

General Work.

A number of individual demonstrations; personal calls given to persons inquiring for information; general boosting and assistance given in plotting and planting vine-berries; inspection of nursery stock; acquiring greenhouse reports for the Lower Mainland; and getting crop reports for Lower Mainland District outside of Chilliwack section, details some of the work which was done in addition to headings throughout this report.

Conclusion.

The commercial production of small fruits should be boosted and encouraged to 500 acres in the Chilliwack-Sardis District.

The Lower Mainland fruit-packs (of small fruits in particular), to par with those of the United States for Prairie markets, must contain fruit picked uniformly on the green side; uniformly graded to United States standards; well filled and the minimum weight stamped on each package.

The Department of Agriculture should purchase at least six 30 x 40 tents for Provincial demonstrations and exhibits at the larger district fairs, wherein butter-making from the Dairy Branch, fruit-handling for the Horticultural Branch, seed-selection for the field crops, etc., could be brought directly to the taxpayers, a small percentage of whom know little of the actual work of the Department.

All of which is respectfully submitted.

K. W. Munson,
District Field Inspector.

REPORT OF PRAIRIE MARKETS COMMISSIONER.

J. A. Grant.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

Sir,—I have the honour to submit herewith my annual report as Prairie Markets Commissioner for the year 1918.

The work of the year 1918 commenced with the fixing of the price for small fruits required for jam-making by the factories. The Island associations closed for strawberries at 9 cents; Mainland associations got as high as 10 cents. These prices advanced to 12 cents when first contracts were filled. Demand was many times greater than the supply, and already at Christmas-time, 1918, contracts are made for 1919 crop at 16 cents per pound, which beats all records in price by a considerable margin.

Berry-growers throughout the Province met together and agreed on this price. Formerly they acted individually or by associations. Your Markets Commissioner has advised them as to the prices obtained as soon as contracts are signed, and this get-together co-ordination will become an annual event. The demand for small fruits for jam, etc., by factories, especially strawberries, raspberries, blackberries, and loganberries, is worth at least passing reference. It is not confined to British Columbia factories, but Eastern Canadian as well, as the Eastern stuff is frozen and shipped when ready in this state. Some of the Eastern houses find that manufacturing in British Columbia for their Western trade would be advantageous, and at least two large concerns will move part of their plant West when a supply of fruit can be assured.

Already Vancouver Island strawberries and Lower Mainland raspberries and blackberries are famous throughout Canada, and many other districts are suited to their growth, some of which, like Salmon Arm and Creston, are already large shippers. Here is one line that can be greatly developed before the demand is supplied.

Visit to United States Competitive Points.

Two visits were made to United States points; one in January, in connection with prices obtained for jam-berries and prices of crates, and investigating methods of regulating growers' supplies in relation to proposition of jam and market supply. The other visit was made to investigate crop conditions and market prospects generally. Every point in marketing was discussed freely with our Southern neighbours and very cordial relations established. The need for a mutual understanding was generally recognized, as our interests in fostering production is common.

MARKET ORGANIZATION.

Early in February the work of organizing the export shipping districts was undertaken. The main effort was made in the Okanagan Valley. While there in connection with organization-work estimates were made of the quantity of onions in storage in British Columbia, and also a report made in the matter of marketing butter by the Armstrong and Kamloops creameries. Kootenay District was also visited and also points on the main line of the Canadian Pacific Railway. Much interest was manifest at the meetings addressed and large audiences attended. The result of this direct personal contact was reflected in the co-operation shown during the season, especially in getting together in quotations from different points for the same produce at an even date.

This work continues to grow, and when better developed the real work of dealing with administrative bodies with a view to tackling the problem of better distribution to Prairie points will be in order. Reference will be made under "Distribution" heading to the possibilities for economy when this question can be adjusted.

STUDY OF TRANSPORTATION PROBLEMS.

After reopening the Calgary office and the introduction of a stenographer there, your Markets Commissioner was able to devote much time to correcting transportation conditions. During the entire shipping season close watch was kept on arriving trains, and through the co-operation of officials of the Dominion Express Company much waste caused by rough handling was averted.

LESS THAN CAR-LOAD LOTS SHIPMENTS.

Shipments by L.C.L. increased greatly last year, owing chiefly to the fact that shippers will not risk shipping in the present type of refrigerator-cars as used by the Dominion Express Company. This has resulted in considerable loss in transit through rough handling at Calgary and other junctional points where diversion takes place. The Dominion Express Company officials worked incessantly to prevent this, but at rush times it got out of control. The chief factors causing this loss were green men, scarcity of labour, and not sufficient attention given by messengers in providing ventilation, as well as unnecessary unloading and reloading. The main difficulty, however, lay in trying to do a superhuman task in the allotted time. A great improvement was noticed as the season advanced, however.

Arrangements are contemplated to test out several cars now in use, giving particular attention to ventilation in each case. This will be under the supervision of officials of the Express and Railway Company, the Dominion Fruit Commissioner, and your Markets Commissioner. The cars to be tested will be the present line car, which carries all fruit from Calgary East L.C.L.; the cowl car that carries berries, etc., from British Columbia points to Calgary; and the Niagara Peninsula fruit-car. The latter gives splendid satisfaction in the East and looks very promising for our needs. One feature of air-circulation *versus* refrigeration in raspberry-carrying was that berries arrived in better condition by the former method, which shows that the refrigerator-car now in use is more a danger than a help for this purpose.

REFRIGERATOR-CARS.

During the entire fruit-shipping season your Markets Commissioner made a careful study of the condition of arrival of British Columbia fruits and vegetables in refrigerator-cars, both in the iced-bunker car and the brine-tank car. The condition of fruit and vegetables arriving from south of the line was also noted. The condition of arrivals in brine-tank cars was usually unsatisfactory: First, because of their being overloaded; and, second, because air-circulation is not provided for.

The iced-bunker cars were satisfactory in carrying strawberries, and ventilation en route was attended to. One brine-tank was experimented with strawberries and it was a failure. The United States refrigerator-cars, being specially built fruit-cars and ventilated, arrived in a uniform satisfactory condition. These consisted of precooled berries from Puyallup and berries from Olalla which were not precooled, as far as we know.

An experiment was made in a mixed shipment, mostly peaches from Washington to Winnipeg, in brine-tank car not precooled. This proved unsatisfactory. There is little or no fruit moved from United States points in brine-tank cars because they have been found unsatisfactory there. The Canadian Pacific Railway has nearly 2,000 brine-tank cars and about 800 iced-bunker cars, none of which are fitted for fruit-carrying.

Two cars of raspberries were loaded in perfect condition at Hatzic, the first of an order for ten cars to Winnipeg. These were shipped in iced-bunker cars and both arrived in a wasting condition, caused by blue mould. The balance of the cars on order were immediately cancelled.

It is vitally important to the upbuilding of the small-fruit industry in British Columbia that satisfactory refrigerator-cars be provided. Its survival depends on this point, as we have already gone beyond our L.C.L. limit. About forty cars of raspberries were shipped to Winnipeg from Puyallup, and arrived in good order, over a greater rail distance than the Hatzic cars. These berries replaced the British Columbia berries on the Prairie market, and unless immediate steps are taken to furnish suitable fruit refrigerator-cars the small-fruit trade will be lost to British Columbia east of Regina. We are pleased to say that the matter is well advanced, and the Canadian Pacific Railway officials, with whom the matter has been discussed at Calgary, Winnipeg, and Montreal, are giving the question serious consideration.

Early Visit to Prairies.

A committee of three, one representing berry-growers, another the brokers, and your Markets Commissioner, was asked to investigate alleged overcharging for strawberries at Prairie points in 1917. Every point was visited and a close scrutiny of sales made, but in no case was any undue profit traced. This visit also served the purpose of apprising jobbers of the prospective crop in British Columbia and the prices likely to rule, and generally putting us in touch with the trade changes since closing the Calgary office in December, 1917, until the reopening in May, 1918.

Calgary Office.

The office in Calgary reopened in May, and during the season until December we kept in constant touch with all matters affecting British Columbia produce and marketing. On account of receiving permission to employ a stenographer at Calgary, we gave a decidedly improved service in replying to telegrams and letters, as during the absence of the Markets Commissioner the stenographer looked after many of them and was able to reach him by wire on important matters. This service was discontinued in December, when the Calgary office was closed for the season.

We would recommend that, in view of the increasing winter shipments to Prairie points, this office be kept open during the winter, with the stenographer in charge, who could at all times keep the Commissioner informed on the state of arrivals of produce and the trade prospect.

We notice every time that the office is closed the connection with the trade is broken. This takes time to catch up, and as our produce will soon be rolling to the Prairies during the entire twelve months this matter should receive favourable consideration.

Prairie Markets Bulletin.

Our first issue this year opened with a circulation of 800, which increased to 1,500 before the close of the season. Applications for the bulletin have been received from many jobbers as well as growers, and during the 1919 season it may be sent to jobbers in all parts of Canada.

The bulletin will be sent free on application to growers of fruit and produce as well as to wholesale dealers in same, and to the press of British Columbia. Members of the British Columbia Fruit-growers' Association receive the bulletin without application by arrangement with the Secretary of that institution.

Next year f.o.b. shipping-point prices will be an outstanding feature, as this year's experience shows that these are more appreciated by growers than wholesale or retail prices.

We take every care to see that our quotations are correct, and will find a market for producers at quoted prices for those who are unable to do so. Our staff correspondents are leaders in the produce business life on the Prairies, and every subject concerning marketing is discussed both from a grower's and buyer's view-point. We are convinced that it is this medium that is responsible for the get-together movement amongst growers and shippers, and its circulation should be increased until it reaches every grower's hands that makes produce-growing a business. It is compiled, printed, and posted every Saturday, and during 1918 we never missed the Saturday mail.

Rhubarb.

Want of organization was evident in handling British Columbia rhubarb. This allowed the f.o.b. buyer to knock the independent grower's house of cards down with arguments relating to offerings he had from other independent growers, and, whether real or imaginary, the result

was that the organized growers got more money for their rhubarb than the unorganized growers; besides, the one sold in car-lots and the other sold in quantities.

It was British Columbia rhubarb that was the best offered on the Prairies, but owing to manipulation on the part of some brokers it did not sell as high as Walla Walla rhubarb. We need a rhubarb-box with less timber and more air-space, as it was rightly claimed that the better-aerated rhubarb kept fresh longest, besides the trade demands to deal with a reliable organization that is large enough to ensure a regular supply.

Districts like Hatzic, which specialize in rhubarb, should grow early potatoes, beets, carrots, etc., to help make up a mixed car-lot. This admits of bringing in fresh rhubarb to small towns, as a full car-lot is more than they can absorb, and keeping of rhubarb too long causes loss in shrinkage and appearance.

HOTHOUSE TOMATOES.

Nearly every hothouse in British Columbia is now shipping tomatoes to the Prairies. The stuff is excellent, and the demand good up to the date when Missouri tomatoes come in car-lots. This industry can be extended and regulated when the greenhouse-men come together for this purpose. Under the present method of shipment there is danger of prices being cut without warrant owing to several wholesalers in one city ordering too heavily.

HOTHOUSE CUCUMBERS.

There is a rapid market for hothouse cukes at prices that should encourage the industry, which is another reason for hothouse-men getting together.

STRAWBERRIES.

Shipments on consignment to the retail trade were not done to any extent this year by white growers. Japanese from the Fraser Valley shipped as usual to any one that would handle their berries. Their pack in the early part of the season was slack and very poor fruit, but improved greatly as the season advanced. The trade complained against Marshall strawberries being shipped to arrive on Saturday. They had to sacrifice them that day, as before Monday they would be almost black in colour. This greatly unbalanced the market. We know a buyer that paid $3 f.o.b. shipping-point for Marshalls, which arrived in Calgary on Saturday and were jobbed at $1 per crate. The season was a great improvement over 1917, both in pack and marketing methods. Lack of organization in some places was the only disturbing factor. The crop was short and demand exceeded the supply. Car-lot shipments in iced-bunker refrigerator-cars arrived in splendid condition, the only exception being the brine-tank refrigerator-car, which was tried out as an experiment. This car arrived showing considerable wastage.

RASPBERRIES.

Car-lot shipments from British Columbia were in demand in Winnipeg, ten cars being on order at a good price. The first two iced-bunker refrigerator-cars shipped out arrived in a wasting condition, due to blue mould, and the balance were immediately cancelled. Raspberries shipped from Puyallup, Washington, which arrived in good condition, took their place, and many more cars were added to the order. This left the shippers the only alternative of using ventilated and line cars, and the whole of their crop was moved out in L.C.L. shipments. If matters are not improved the raspberry-supply of Eastern Saskatchewan and Manitoba will be lost to British Columbia.

BLACKBERRIES, LOGANBERRIES, CURRANTS, AND GOOSEBERRIES.

The above fruits were in increased demand and prices received were satisfactory. The best package for gooseberries is the Ontario 6-quart crate-basket. These baskets prevent the berries from falling out, as is often noticeable in the crate, if the lids are properly fastened on.

Growers should not increase their acreage for black currants or gooseberries, as the demand is limited and present shipment seems ample to supply present demands.

CHERRIES.

Cherries were a bumper crop. Early Richmonds and Governor Woods come in competition with Washington Bings and Lamberts. The contrast was reflected in the prices obtained. The supply exceeded the demand at one time, due to the jobbers misjudging the size of the British Columbia crop and importing too heavily from Washington. When the error was corrected

British Columbia Bings and Lamberts were in demand, and sold for a good price when the quality was good. The loss on Lamberts and Bings, that fell so heavily on some shippers, was due to splitting, mould, and rot, which causes them to leak badly, smearing the crates, thereby giving them an unattractive appearance. Steps should be taken to get close estimates of the crop in advance of its ripening season.

Apricots and Peaches.

Early estimates of the crop of these fruits in British Columbia were low, and before the real situation was made known jobbers on the Prairies had protected their trade by buying heavily in Washington. Our apricots and peaches were of good size and quality and the prices secured were good. Considerable loss was taken by overloading in transit and by careless mixing in cars containing vegetables, and in some cases due to holding too long at shipping-point. The pack was good.

Prunes and Plums.

The opening of the season for prunes and plums boded well for British Columbia supplies. The American embargo on prunes looked like a monopoly of this market for British Columbia. Sugar restrictions on both sides of the line seriously interfered with their going into consumption. For this reason Washington prices enticed jobbers here to bring many car-lots in at a shade under our prices, and, coupled with our bumper crop and bare sugar-supply, shot this market to bits. Splitting and plum-rot caused by the heavy rains in British Columbia brought them on this market in similar condition as explained in the cherries. The appearance of the crates smeared with juice looked worse than the actual state of the fruit.

Pears.

The market for pears was unusually good and prices were high for good stock. There is a growing market for our pears, and if the varieties are grown that the market demands pear-growing should be profitable. Beurre d'Anjou is the variety mostly favoured and it commands the top price. The favourite fall pear from California is the Marceau. It holds up well, and if it can be successfully grown in British Columbia it should be tried out. Its season is after the Anjou, to December and January. Bartletts and Flemish Beautys that came on the market earlier sold well. The demand for pears of good quality exceeded the supply.

Apples.

This king of our export fruit has been before the public a long time, and many improvements have been made in grade and pack. The trade has little now to suggest in improving the package, as the box now standardized gives satisfaction.

Several popular fall and winter varieties have advanced in price when offered with less popular varieties. The No. 1A so-called class commands from 50 cents to $1 per case more than No. 1B class. No. 1A Spys, Newtowns, Spitz, Winesaps, Kings, Baldwins, and Jonathans lead this class, and if scarce may find themselves ranged in No. 1A.

Prairie and Eastern dealers find that British Columbia shippers scarcely measure up to the American pack and colour. In order to base prices on a level with United States competition we must equal their average pack. It is essential that our No. 1 export stuff should be raised and at least 40 per cent. not included placed in No. 2 and No. 3 grades. No. 2 should then be better and the No. 3 also raised so that it will class with American C grade. Crated stock can take care of the doubtful balance.

There is a small first-class trade on the Prairies which demands the best we have. There is an immense trade there for a semi-perfect apple, such as the No. 2 would then be, and outlet for all our No. 3 and crated stuff for some time to come. Prices between No. 1 fancy and No. 2 are now far too close, and No. 3 is too close to No. 2. This year the Eastern trade absorbed a lot of our No. 1 fancy, and this allows the fancy trade to have the choice apples at a choice price. This fancy stuff should furnish the main profit of the apple-crop and allow the balance of the crop to be sold more reasonably.

The limit of price for Prairie general trade has been passed, and in order to encourage greater consumption prices for domestic stuff must be placed within the reach of the masses of the people.

The marketing methods in British Columbia improved greatly in 1918. Many objectional features of selling were overcome, or at least greatly reduced.

POTATOES.

British Columbia shipments were heavier than usual this year. The quality and grade was unsatisfactory, showing carelessness at shipping-point. Prices were good. Immature potatoes were too much in evidence, some showing from 20 to 40 per cent. shrinkage. Forcing too many in this state on the Prairie market in the season, in an effort to partake of the cream of prices, was practised long after your Markets Commissioner called attention to the danger. This resulted in breaking the price, and it is known that the lowest price for potatoes this year was at the time when new potatoes were little over half-grown. Potatoes from British Columbia are unexcelled in quality and the price obtained is from $5 to $20 a ton more than Alberta-grown potatoes. For this reason greater care in sorting interprovincial shipments should be compulsory. Potatoes from marble size to turnip size in the same sack and too small and too large potatoes all classed No. 1 will not tend to place our potatoes in a favourable light for Prairie buyers.

Many refusals of shipments for this reason were recorded, and your Markets Commissioner was constantly being called in to examine and adjust such shipment.

SWEET POTATOES.

So far we have not seen any British Columbia sweet potatoes on the Prairie markets. The Prairies use many car-loads of sweet potatoes annually, and many of the Prairie jobbers are of the opinion that certain localities in British Columbia are suited to growing them, especially that district from Penticton to Keremeos. I am also informed that experiments have been made at Summerland with some success, but the soil there was a little too stiff. This is a promising enterprise, and an assured market awaits successful growers.

FIELD TOMATOES.

British Columbia field-grown tomatoes were shipped in greatly increased lots, both green and ripe. They gave general satisfaction in quality and weight and good prices were obtained. More care is needed in grading, also in placing ripe, semi-ripe, and green in different packages.

Walhachin and Keremeos had a shade over other districts in the quality and pack. Bright lithographs should be used on the tomato-crates and wrapping should be dispensed with.

CELERY.

Armstrong celery was much in evidence on all Prairie markets. The early celery was the cause of grief, because it was shipped immature and in mixed cars, both potatoes and celery arrived showing great wastage. The later celery came on the market in prime condition and was in great demand.

With care in preparing and shipping, there is no reason why Canada, from east to west, should not buy Armstrong celery, as it is freely admitted to be the best on the market.

CITRON, SQUASH, AND PUMPKIN.

The amount of citron grown in British Columbia is increasing, and if much greater increase takes place it is the intention of the Markets Commissioner to take up the matter of using the citron for candied purposes with British Columbia and Eastern preserving-factories. British Columbia is well adapted to citron-growing, and in order to extend this enterprise a factory outlet is needed, as the citron is capable of producing a great tonnage per acre.

Pumpkin-growers should grow sugar-pumpkin for culinary use. It is uniform, small, good colour, and an excellent shipper, and in crates they are very popular. The "Connecticut field" now principally grown is too large and irregular in size, and dealers prefer the smaller and superior-flavoured pumpkin.

Hubbard squash is in good demand on the Prairie market, but too many unripe specimens were shipped last season. If grading and ripening were properly done, the trade would venture on car-lots of these commodities instead of the L.C.L. lots not purchased.

CANTALOUPES.

The growing of cantaloupes in Okanagan Valley for Prairie shipment can be greatly increased. The last year's shipments were generally kept too long before being shipped, arriving overripe and mouldy. Prices for hard, ripe cantaloupes ruled high and graded stock was favoured.

Cucumbers, Field and Picklers.

Field-grown cucumbers arrived in great volume, but as a rule of poor variety. Better grading is greatly needed and the variety of sorts is too numerous.

Grading as to size and shipping only green specimens should be the motto. Pickling and irregular stuff should be kept out and overripes should never be shipped. There is need for the selection of a special shipping variety. Some growers have them and ship just at the right time, but the bulk of the 1918 shipments seemed to include everything on the vine.

Cukes do not tavel well in iced cars, and they should be shipped by L.C.L. express when intended for table use. During the peak of the season it will not pay to ship everything that grows on the vine. Green, well-grown specimens of uniform size only should be shipped. There is a great demand for picklers at British Columbia preserving-factories at fair prices.

Notes and Impressions.

Shipment on consignment to retail trade was greatly demanded. The demand for strawberries and raspberries greatly exceeded the supply.

The British Columbia pack of small fruits, with few exceptions, was a great improvement over the previous year. Most of the losses suffered were apparently in transit, as few indications of carelessness on shippers' part was noticed. The exception to this was shipments made after rains.

The Magoon strawberry is the best shipper next to the Clark's Seedling, and that the Cuthbert raspberry is easily the best all-round berry.

That the British Columbia rhubarb-box is too closely built, too heavy, and needs more air-space. That British Columbia rhubarb is better in colour, crisper, and of better flavour than any other on the Prairie market.

That Walla Walla rhubarb holds up better owing to the greater chance for air-circulation in the box in which it is packed.

That early potatoes and vegetables should be grown to mix in the car-load of rhubarb.

Wynndel strawberry-crates with attractive lithographed ends are more attractive than the printed ends.

Crop Estimates.

Early estimates of the British Columbia fruit-crop, especially those made of the Okanagan crop after a severe frost last season, were entirely at sea. Especially was this noted in cherries and apricots, but plums, prunes, and peaches were greatly underestimated. British Columbia shippers know that Prairie jobbers and brokers seek to ensure a supply for their needs in various lines in advance of ripening season. If British Columbia fruitmen cannot furnish enough, the balance is secured in the United States, even at an advance over our quotations. As produce from the South arrives on the market ahead of ours, the mischief in underestimation of our crop is done before the British Columbia crop commences to roll, and even when it is rolling. This resulted in bringing to the Prairie market much fruit that overlapped ours and thereby unbalanced the market. The difference between early estimates and the actual crop should be checked up several times and corrected, so that the discrepancy will be slight.

Bearish Outlook.

The shippers and jobbers of British Columbia and Prairies have taken considerable loss in last year's business. They were compelled to buy on a high market, and owing to the crop-failure in Alberta under sugar-supply and food-control the market remained dull and lifeless, and a tendency was ever present for prices to fall instead of to rise. This, with loss in transit, shipping immature stuff, and heating due to overloading, made the way of the wholesaler hard. Untimely and misunderstood sugar restriction and poor distribution threatened the loss of hundreds of cars of fruit.

Your Markets Commissioner took up this matter in an urgent manner, both with Ottawa and Vancouver, and succeeded, with their help, in relieving the situation.

The general loss sustained throughout the 1918 season will ultimately reflect on the British Columbia growers of produce. There will be more buying from hand to mouth and less storage on the Prairies than formerly. This condition is not what growers want, but storage facilities

at shipping-point are imperative if prices are to be maintained and regulated by the producers on the basis of supply and demand. The wholesalers have taken losses in storage for some years. Much of their shrinkage has been due to Jonathan scald and bitter-pit developing in storage, and in all fairness this should be partially borne by the growers. It is not a hopeful outlook when dealers are losing money, and while in the past the growers have suffered unfairly, still we must place our wares in the hands of the wholesalers in such condition as will enable them to handle profitably. In other words, we must stand behind honest dealers.

Growers of fruit and produce must be on their guard against the bearish tendency, as it will surely be carried too far if some effort is not made to counteract it.

The strongest market will be found where growers are in control of their brokers and have their own selling agencies. This point cannot be too much emphasized, as the experience of the past, wherein the price of production was not obtained by growers, was largely the result of jobbers and brokers being in control of the market.

DISTRIBUTION.

On a widely separated market, such as obtains on the Prairies, distribution becomes one of our greatest problems. Our present method is a marked improvement on past efforts, but much can be done to economize in freight, secure adequate supply, and prevent undersupply at different points. The Okanagan United Growers and Okanagan houses supply the bulk of the produce shipped in. The unity of purpose amongst these shippers should be an instrument to greatly overcome the distributing difficulty.

If it were possible to establish a Shipping Union Distributing Depot at Calgary, many of the cars now broken up there and distributed throughout the Prairies as piecemeal could be diverted to points *en bloc*. This system is practised by the British Columbia Sugar Refinery in distributing their sugar. Perishable produce would better lend itself to this method.

When British Columbia shippers unite for this purpose the cost to the consumer can be greatly reduced, and the growing shortage of cars would be relieved. The logical distributing-point for the Prairies and Eastern Canada at the present time is Calgary.

Place of Shipment.	First Assembly Point.
Creston and Kootenay, through the Crow	Calgary.
Grand Forks, via Penticton and Sicamous	"
Lytton, Walbachin, Kamloops, and Salmon Arm, via main line	"
Arrow Lakes, via Revelstoke, main line	"
Athalmer, Windermere, via Golden, main line	"
Island and Lower Mainland, via main line	"
Okanagan, Keremeos, via main line	"

Calgary as a distributing-point would allow the whole Province to distribute from one depot. This can be worked out in detail as associations grow sufficiently, but the immediate effort should be directed to one central point instead of many expensive offices scattered through the small shipping centres of British Columbia.

UNITED STATES SHIPMENTS.

Considerable fruit shipments were made from British Columbia to points in the United States, chiefly to Minneapolis, St. Paul, and Duluth. An experiment with shipping prunes to St. Paul was only a partial success. This was largely due to the soft condition on arrival.

BRITISH EMBARGO.

The British embargo on apples was removed in November, just too late to be of much benefit, as at that date the shippers had placed almost all their stock.

The restrictions now imposed by the British Food Control Board favour the importation of poor-grade apples, but these restrictions are only temporary. The prohibitive freight rates from Halifax to Liverpool will also soon adjust themselves to normal conditions. Taking it into review that we were able to expand our interprovincial trade during the embargo period, its removal brightens the outlook. Prospect for the extension of our export trade is very bright, and full advantage should be taken of the time of market reorganization in Britain to get into touch with British dealers before they get satisfaction from foreign sources.

Loss caused by Unusual Conditions in 1918.

During 1918 we have had many unforeseen conditions to combat, some of the elements which threw in unusual climatic conditions, with their attending evils, bringing heavy losses in their wake. We need not enumerate them as they are unlikely to return for years, but here we will mention that the loss from wastage in cherries, plums, and prunes was due in a large measure to these causes.

Emergency Advertising.

The season of 1918 provided few emergencies where supply exceeded demand. The markets were well supplied, but seldom oversupplied. The exception to this came in cherries, plums, prunes, tomatoes, and cucumbers. Emergency advertising was resorted to, and several leading articles were written with the authority of the Markets Commissioner, calling the attention of housewives to the passing of the season. This had usually the desired result.

The other matter of urgency was the advertising of how to preserve with minimum of sugar and assuring housewives that for making crab-apple jelly abundant sugar could be purchased with the approval of the Canada Food Board.

British Columbia fruit-growers should have a reserve fund for emergency purposes, as without it many thousands of dollars may be lost. Last season the situation was bridged by the wholesale trade doing the advertising, supplemented by the British Columbia Fruit-growers' Association.

There is a great scarcity of home-preserved fruits, due to fruit and sugar shortage, which promises well for good prices during the season 1919.

Visit to Eastern Markets.

After the last issue of the Prairie Market Bulletin your Markets Commissioner visited Toronto, Ottawa, and Montreal with a view to market extension. The brokers and jobbers in these cities were called on and some of the leading retail merchants interviewed.

Our apples are in good repute and boxed apples from British Columbia are increasing in demand very fast. It is admitted there that the fruit from the Western States is the only competition we have to count upon. While our produce is popular, it is quoted as high as Washington and Montana stuff. It is claimed rightly that our grade and colour is less carefully put up, and that our boxed apples for this reason should be quoted from 10 to 25 cents a box delivered less than similar varieties from the United States. Eastern buyers would prefer an equal pack at an equal price, as colour and uniform size is more important than price.

There is a demand for our Bing and Lambert cherries in 10-lb. flat or 24 deep pint crates by the car-lot in Montreal and Ottawa, and for our Italian prunes in all three cities. These cities are the distributing-point for all Eastern Canadian points that are interested in British Columbia fruit or vegetables.

Our trade east of Winnipeg in 1918 was more than double 1917, and this market should be supplied with only choice produce, for the reason that their own produce of similar kind to what we ship in is of very good quality, and it is only the superior grades that interest them. For this reason a careful inspection should precede shipments east of Port Arthur to ensure a high quality only being shipped to Eastern points. Our aim should be to equal the produce shipped by our Southern competitors.

The Eastern Canada market for British Columbia apples, cherries, and plums has been further developed this year, and our east of Winnipeg sales this year have doubled last year's output.

Ontario and Quebec had a fair crop of clean fruit, and notwithstanding this fact the fancy trade prefers the box British Columbia fruit to the Eastern barrelled stuff. The increase of our shipments means the displacement of North-western States importations.

The uncertainty of fruit rates on British Columbia apples to Montreal was the means of a loss of many cars of fruit this year. This matter should be settled beyond doubt this year long before the apples are ready to ship.

The Eastern trade can be doubled several times if the British Columbia shippers would enforce a discipline amongst their growers of a rigid kind. It should be borne in mind that only fancy stuff of highest grade is needed in Ontario and Quebec.

CONCLUSION.

This report would be incomplete without reference to the splendid co-operative spirit and willingness to exchange marketing information between our office and managers of competitive concerns in the North-western States. Expressions of a hope that British Columbia concerns would join with them in equalizing express freight rates and in all other things that point to their mutual interests. We tender these officials a furtherance of our sincere thanks for much valuable information supplied, and include the United States Market Bureau of Washington, D.C., and the Spokane branch of same.

We also want to commend the cordial co-operation of the Dominion Inspectors under C. W. Baxter in helping to raise the standard of our pack without undue injury to the producer who is entering the shipping business, and also appreciate the splendid offer of the Chief Dominion Fruit Commissioner to co-operate to the limit of his power with all Provincial efforts towards the betterment of marketing Canadian fruit. Also the prompt and reliable service rendered by Assistant Horticulturists and fieldmen of the British Columbia Horticultural staff, and the British Columbia Coast Markets Commissioner for assistance in organizing growers in British Columbia for Prairie trade shipment, and also for timely help in relieving the sugar shortage on Prairies and adjusting the potato glut in the early season at Calgary.

All of which is respectfully submitted.

J. A. GRANT,
Prairie Markets Commissioner.

REPORT OF COAST MARKETS COMMISSIONER AND INSPECTOR IN CHARGE OF EXPORTS.

R. C. ABBOTT.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—I have the honour to submit herewith my fourth annual report on marketing conditions in the Coast section of the Province of British Columbia; also report on the inspection-work under my charge during the year 1918.

WEEKLY MARKET LETTERS.

As in former years, weekly market letters have been issued from this office to farmers, transportation company officials, shipping and wholesale firms; also to a large number of newspaper concerns, who desired the same for publication. These reports were mailed to any interested party upon request. At the end of the year our mailing-list contained some 1,185 names.

We have experienced a great deal of difficulty in issuing these reports this year. During the first part of the season we could not obtain the proper brand of ink, and after installing a new machine we were confronted with the fact that the entire supply of paper used in this work was exhausted and we were compelled to use a very inferior substitute. Both these factors were uncontrollable.

In these letters we confined ourselves as much as possible to market problems affecting the individual producer and Farmers' Co-operative Associations. Market questions of immediate issue were discussed in these letters, and many letters of appreciation have been received from farmers who take an interest in the marketing problems of the day.

A large number of individual inquiries from producers have been answered by letter, telephone, and telegraph.

ACTIVITIES OF THE OFFICE.

During the spring of 1918 this office gave assistance to growers of Burnaby in the line of organization. A number of meetings were held and two co-operative organizations were formed—namely, the Burnaby Lake Fruit-growers' Association and the Burnaby Producers' Co-operative Association. Owing to the geographical construction of Burnaby District it was thought best to form two organizations—one to look after the interests of the growers on the Burnaby Lake line of the British Columbia Electric Railway, and the other to operate on the Central Park line or West Burnaby.

After organization assistance was given these associations by arranging contracts for their fruits. These contracts were made with one wholesale firm at a fixed price at the farms of the growers for the entire crop of strawberries and raspberries. The contract price was $2.50 for No. 1 strawberries and $2.10 for No. 1 raspberries.

The Burnaby Lake Association handled lime and boxes, etc., for their members, and reported a very successful season.

Every encouragement was given these organizations in the use of the two-fifth shipping-crate for raspberries in preference to the two-fifth local, as used in former years. The former association used the two-fifth shipping-crate entirely, while the latter shipped in the two-fifth local crate. Hence the discouraging results obtained by the latter association.

During the berry season a number of fruit picking and packing demonstrations were held in these two districts. These were very well attended and the results obtained were good.

Assistance was also given the North Vancouver Producers' Association in the organization of their association for the handling of eggs, poultry-feed, and supplies.

Adjustment of Disputes between Consignee and Consignor.—Many shipments of fruit and farm produce are received by buyers here which do not come up to the standards or which may be spoiled in transit. In such cases, upon request of either party, this office made inspection and issued an unbiased report of the actual conditions of the shipment. In some instances, where farmers living at a distance were unable to come to the city and make their own adjustments, this office made the required adjustment. In no instance does this office accept any remittance for the producer, but always insists on cheques being made out direct to the shipper and mailed in our presence when possible.

Overcharges in Freight and Express.—We also made adjustments of overcharges in freight and express for growers who were not in a position to do so themselves.

Storage Investigations.—Investigations into the methods of storing potatoes have been carried on during the last three years, and from the information obtained much timely advice was given out this season during the storing period.

Loss in Transit from Improper Loading.—Investigations made by this office in regard to loss in transit show that a very large percentage of this loss, as well as a great deal of the disagreements and disputes between the shipper and the buyer, is caused by improper loading. Every season there are heavy losses in tomatoes, peaches, and apricots, caused from being loaded without making provision for proper circulation of air and lack of icing cars.

The losses in potatoes have been heavy. It was found, on investigation, that potatoes grown in the districts of Lillooet and Ashcroft showed the heaviest shinkage within a period of sixty days after digging. Our investigations in 1917 brought out the facts that potatoes in these districts, when dug, had a temperature of from 70 to 83° Fahr. These, when dug, sacked, and loaded tightly in cars without any ventilation, went through a severe process of sweating. The high temperature and the moisture brought out or developed *Fusarium* diseases, such as jelly end-rot and black-rot (Western field-rot). Black-heart was also developed, which is caused by poor storage such as we find in tightly closed cars.

During the fall of 1918 Mr. Gutteridge, Assistant Potato Inspector, was stationed at Lillooet and gave the growers of that district much useful information in the proper loading of cars. As to the results of his work in that district, I have only to state that all cars were checked at this end and those loaded according to instructions arrived here in the best of condition, while at least 90 per cent. of those shipped under the usual method of loading showed shrinkage.

In this connection I cite one case of where a dispute arose between the shipper and the buyer over the condition of three car-loads of potatoes. In order to test out the necessity of absolute protection for the producer and the feasibility of handling such cases, this office undertook the supervision of picking over and regrading the three cars, with the result that 14 tons 2 cwt. of potatoes were saved and sold for $27.50 per ton; whereas under ordinary methods of resorting in the wholesale houses these would have been an absolute loss and charged back to the grower. The results obtained in the above instance were so encouraging that the work was continued throughout the shipping season, and the work of resorting some forty-eight cars, over

There is much work to be carried on in this line, and it is the aim of this office to continue which disputes between grower and buyer arose, was carried on under the supervision of this office. these investigations, with the hope of educating the shippers to the great necessity of proper loading of produce to ensure safe transportation.

The heavy minimum insisted on by the railroads has, in my opinion, been more of a detriment than a benefit and has caused a wanton wastage in foodstuffs, which eventually terminated in high prices to the consumer.

Advice to Shippers.—In all cases where we find shipments arriving in poor condition we immediately write the shipper and draw his attention to the fact; also giving him advice on how to grade and pack and the best methods to use when putting his produce on the market to obtain the best results.

Fruit Inspection.—During the caterpillar epidemic in Vancouver City, South Vancouver, and Point Grey the inspection-work was carried on by this office; 3,110 inspections were made and forty-one quarantine notices issued.

This inspection is a very hard one to handle owing to the fact that there are only one or two trees in each back yard. Very few of the owners of the property have spray-pumps. We found in the majority of cases that the owners or tenants of the property were not willing to invest in spray-pumps, but were willing to pay for having their trees sprayed. The inspection took in an area running from Cedar Cove to Central Park in a line with Cedar Cottage on the east, and extended west to Arbutus Street and in southerly line to Eburne and south-east to Central Park.

There is every indication of a severe outbreak in 1919 in this same district. While experts claim that this year will see the last of the worst of this epidemic, we might say that in our work of 1918 we saw very little evidence of parasitizing.

Egg Inspection.—No Chinese eggs have been marketed here this year. Imports from Eastern Canadian points and the Prairie Provinces composed the greater part of our outside supply, a very small quantity coming in from the United States as compared with other years.

Potato Inspection.—This work not only covered all export shipments from west of Yale, but also inspection on local shipments.

General Inspection.—General inspection was given on all lines of produce, including poultry and dressed meats, shipped by producers. When these were not up to the standard, letters were written to the producers advising them of the best methods to put same up for the market.

LOCAL MARKETS.

During the whole year of 1918 our local markets were well supplied with British Columbia fruit and produce.

Strawberries.—The price of strawberries remained high throughout the season. The main supply came from Vancouver Island and Burnaby. Haney and Burnaby Districts were under contract with wholesale houses here. The quality in general was only fair as compared with other seasons.

Ever-bearing varieties were on the market almost continually up to December 1st. These berries sold wholesale at an average price of $4.50 per pint crate. The demand will take a considerable quantity of these, and it will no doubt be several years before there is any over-production of this fruit, as their carrying qualities appear to be conducive to long-distant shipping.

Even though the prices for the main crop of strawberries were out of the reach of the ordinary householder for canning purposes, the supply was below the demand.

Raspberries.—The raspberry business was pretty well in the hands of three wholesalers. The season was bad and difficulty was experienced in getting berries in shape to stand up for long shipments.

Close investigations have led us to believe that the Antwerp variety should not be grown here for shipping purposes. After a careful study we believe the time is near when Herberts and Cuthberts will demand a premium over Antwerps even on the local market. Although the production of raspberries is gradually increasing, the demand is increasing more rapidly.

Blackberries.—There were very few of these on the Coast markets this season. The demand is not great, but it is encouraging to note the increased demand from the middle Provinces for the Evergreen variety. The acreage in these is very small, and while from some quarters an increased production is encouraged, we believe this can easily be overcome unless some assurance of the demand comes from the cannerymen.

NOTE.—Several car-loads of strawberries, raspberries, and blackberries were frozen and shipped to Ontario for canning purposes.

Loganberries.—The supply was far short of the demand. Prices were good. In our opinion the demand for these berries will increase each year and increased production can safely be encouraged. This berry is fast becoming a favourite on all markets and is a profitable one from both the producer's and the consumer's standpoint.

Gooseberries.—The greater portion of the gooseberries shipped here during 1918 were shipped in bulk and sold by the pound. The demand was not strong owing to the sugar situation.

Currants.—The demand for reds was good and is gradually increasing. Blacks were short on supply.

Cherries.—Sour cherries were a drug on the market. Sweets of the Bing and Lambert varieties were in good demand. British Columbia supplied the bulk of the supply this season.

Plums and Prunes.—In previous years the Lower Mainland shipped these in in quantities far in excess of the demand, but owing to the ice-storm in the early spring of 1918 many trees were broken down and thus the supply was cut down. Very little wastage was reported this season.

Apricots, Peaches, and Pears.—Very few apricots came in from British Columbia points. The supply of British Columbia peaches was much greater than in former years and found a ready market.

Pears from local points were marketed loose in orchard-boxes and a large quantity was moved. Bartletts and Clarigeaus from the Island found a ready demand. The Coast markets are always good for good pears.

Apples.—British Columbia apples are to be found in every wholesale fruit and produce house on the Coast. Foreign apples were only imported early in the spring when British Columbia apples could not be supplied. Apples of all varieties appeared to fall down quickly this season and we heard the same complaint from every quarter.

The crowding of winter varieties on fall varieties has caused considerable loss. As soon as long-keeping varieties are on the market retailers will take these every time in preference to fall varieties. This leaves the fall varieties on the wholesalers' hands and they are ultimately "slumped" or lost.

Potatoes.—During the early part of this year this office experienced much difficulty in the marketing of potatoes owing to the various conflicting reports published by members of the Canada Food Board Committee and speculators. Shipments to the Prairie Provinces commenced on January 17th and continued up to May 23rd. The total shipments in this period amounted to 245 cars of an average of 22½ tons per car. These shipments were all inspected and certificates issued.

New Potato Shipments.—New potato shipments from East Delta commenced on July 2nd and continued to August 23rd. These amounted to thirty-eight cars, thirty-five going to the Middle West and three to the United States.

Mixed Vegetables.—The quantities of parsnips, beets, and turnips shipped export far exceeded previous years. Shimpents of new cabbage during July amounted to 50 tons. These were of excellent quality and of good size. The total shipments of mixed cars of vegetables for the year from the district west of Yale amounted to twenty-two cars. This and the new potato shipments is all new business and proves beyond a doubt that these shipments can be greatly increased.

Dry Beans.—During the early part of 1918 beans went as high as 13½ cents a pound to the grower and speculators bought up the whole crop. This high price encouraged growers to grow larger quantities in the season of 1918, which is practically all in the hands of the growers at the present time. The high prices of the 1917 crop retarded consumption and many car-loads of the 1917 crop are still in the hands of the buyers. In spite of the fact that we have a large supply in British Columbia, shipments of Oriental beans continue to arrive.

It might be well to mention here that Pintos and coloured beans are gaining favour on the markets and are now commanding almost as high a price as the white Navy bean.

Onions.—The quality of British Columbia onions this season in general was good, although the size was much below what was required by the market. Heavy loading in the cars without decks was the cause of much waste.

Tomatoes.—Hothouse tomatoes were in good supply and the prices held high throughout the season. A very large increase in the Eastern shipments was recorded. Field tomatoes came in early from Departure Bay. These were of good quality and exceptionally well graded and packed. Car-load lots from the Interior of British Columbia came in in lug-boxes, crates, and tomato-boxes. The lug-boxes met to some extent the cheaper demand for home canning.

Miscellaneous Fruits and Vegetables.—British Columbia sweet chestnuts, walnuts, and filberts were on the market in small quantities. The chestnuts and walnuts were of excellent quality. The filberts were picked too green and in our opinion placed on the market at least one month too soon.

Vancouver City takes approximately 50,000 lb. of sweet chestnuts, besides several cars of walnuts and filberts. All three of these grow and bear well in the Lower Fraser Valley and we believe the planting of these nuts should be encouraged.

Considerable quantities of home-grown Jerusalem artichokes were marketed during the fall. In one enterprising garden at Kerrisdale, Globe artichokes were grown very successfully, and it would appear from this year's success that it will be quite possible to grow these on a commercial scale.

Head-lettuce is always in great demand in the Coast cities and 1918 was really the first year any great quantities were grown in British Columbia. The Chinese gardeners were able to grow this very successfully and several acres were marketed in the City of Vancouver.

Cucumbers, for both pickling and market sale, were grown very extensively and successfully on the Lower Mainland.

Eggs and Poultry.—Eggs reached the highest price in November, 1918, that has been recorded in British Columbia for over thirty years; eggs reached retail at as high as $1.20 a dozen; while poultry, milk-fed, retailed at 70 cents and turkeys at 75 cents a pound.

Large quantities of turkeys reached this market from Alberta during the month of December. These were laid down in Vancouver at 42 cents per pound and retailed at 55 and 60 cents per pound. There was a very large increase in local turkeys this year. This was fine stock and in some instances the farmers were paid 62 cents per pound dressed.

Hay and Grain.—Hay prices have held high, with the exception of alfalfa. This dropped early in December owing to the heavy importations from the State of Washington. Local oats cleaned up early.

Hogs and Dressed Pork.—Live hogs held up well until December, when there was a sudden drop in prices of 4 cents a pound to the farmer. Retail prices held even. Young pigs, although scarce in the spring and prices became exorbitant, met with a severe "slump" early in the fall, when the market became so overcrowded with small pigs that some lots had to be returned to the shipper unsold.

SUMMARY.

In looking back over the year we find little complaint can be made from the producer's standpoint. It might be stated here that our investigations disclosed the fact that, due to the high prices, many farmers and shippers took a chance on the markets with inferior stuff and eventually lost out, as the markets will only stand a limited quantity and dealers will only tolerate this kind of business to a very small degree.

Respectfully submitted.

R. C. ABBOTT,
Coast Markets Commissioner and Inspector in Charge of Exports.

REPORT OF PROVINCIAL PLANT PATHOLOGIST.

J. W. EASTHAM, B.Sc.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—I have the honour to submit herewith my annual report for the year 1918.

NEW DISEASES.

Leaf-roll of Potatoes.—This disease has for some time been receiving serious consideration in the East, being regarded as one of the chief causes of poor yields. It is not, so far as can be discovered, due to any parasite, but to some degenerative change in the constitution of the plant. It is transmitted by the use of tubers from diseased plants for seed, plants from such seed usually showing the disease in an increased degree. Badly affected plants are readily recognized by the rolling-up of the leaves from the margin and by the often numerous small tubers set close to the base of the stem. The disease has not been noticed in British Columbia previous to this

year, when a very well-marked case was found in the vicinity of Vancouver, a large proportion of the plants of several varieties being so badly affected as to be worthless. Since the disease is not of parasitic origin, special measures such as spraying are of no value, the only means of preventing its increase being to select for seed only tubers from healthy plants. This means the use of a seed-plot with careful "roguing-out" of diseased plants or selection of seed from sound and prolific plants only from the general crop.

White-pine Blister-rust.—This disease appears to have its origin in Russia and Siberia and was probably introduced into the Eastern part of this continent about ten years ago in importations of white-pine seedlings from Europe. About three years ago it was found to be established in a number of the States and Provinces beyond hope of eradication. Like many other rust fungi, the parasite has two alternate host-plants; in this case five-leaved pines being one host and species of *Ribes* (gooseberries and currants, including wild forms) the other. The disease may be carried on either of these types of plant, although it is destructive chiefly to pines. There is some reason to believe that the western white pine (*Pinus monticola*) is more susceptible than the eastern species (*Pinus strobus*), and therefore that the disease would be more severe in the West than in the East should it become established.

During the past season I have made numerous examinations of currants and gooseberries for the stage of the rust occurring on them, with negative results. The stands of white pine, however, are somewhat remote from the centres of cultivation and no attempt has been made to make an adequate inspection of the pine districts. In the Kootenays, and particularly in the vicinity of Kaslo, however, a large number of pines were examined and no rust found. Importation of five-leaved pines have been prohibited since 1917, but the files of the office of the Inspector of Imported Stock have been gone over for the preceding five years in an effort to trace shipments of these. This has not proved very satisfactory, since many such pines might be included under the invoice titles "evergreens," "ornamentals," etc., but a number of importations have been followed up and the plants inspected. In this case also no disease has been found. There is reason for hoping, therefore, that the Province is at present free from the disease and may be kept or if adequate measures are taken to exclude possible carriers of the disease.

Experimental Spraying.

Apple Anthracnose.—This work was continued at Keating, V.I., in co-operation with E. W. White, the same plots being used. The early spray, with 3-4-40 Bordeaux mixture, was given on September 1st, 1917, and the late one, with 6-6-40 strength, on October 30th. The cankers were counted on May 14th, 1918. The difference in the appearance of the trees as compared with their condition two years ago when first sprayed was very marked. The new growth having been preserved for two years, it was not possible to count all the twigs and the cankers on each as was previously done. Alternate trees in each row were closely examined for new cankers. Six trees, sprayed with the early spray only, showed thirteen new cankers, an average of a little over two per tree. On five trees which received both sprayings seven new cankers could be found. Five trees, which received the late spraying only, had an aggregate of fifty-two new cankers, or an average of 10.4 per tree. The evidence in favour of early spraying, even with Bordeaux mixture of half the strength used later, was again convincing. An unsprayed tree similar in every respect to those in the sprayed plot and adjoining them showed fifty-three new cankers, only a portion of the tree being examined. As in the previous year, the apples, when packed early in January, required no special treatment, and therefore no cost was incurred over and above that of the actual spraying, which amounted to about 15½ cents per tree for the first application and 24 cents for the second. Since the first spraying was almost as effective as both combined, the cost of protection is comparatively slight. The effects of the previous year's spraying were already of practical value, the grower stating his 1917 harvest to be the best he had had for many years from these trees.

Apple-scab.

The work on apple-scab control was again carried out in co-operation with the staff of the Horticultural Branch on the same plots at Salmon Arm, Vernon, Forslunds (on the Arrow Lakes), Nelson, and Creston. This is the third year that this work has been carried on. Certain problems remain for further investigation, but the three-year tests have given us the necessary data for recommendations for scab-control, in an ordinary year, in any of the above localities.

The rains in mid-August introduced a new factor this year and the late spray which in previous years had appeared to be money thrown away proved valuable. A detailed analysis of results is not given here, as it is proposed to publish them in bulletin form.

POTATO-DISEASES.

Early in the year, at a conference between the Plant Pathologist and the staff of the Soil and Crop Division, it was decided to inaugurate some work, partly experimental, partly demonstrative, to improve the yield of potatoes in the Lower Fraser Valley. This work was to include the selection of seed from the owner's stock when this was reasonably satisfactory in quality, disinfection of the same with formaldehyde, and the spraying of the growing plants as a protection against late blight. The work was carried out by E. Hogan, A. P. W. Anketell-Jones, and myself, the last-named being responsible for the direction and checking-up of the disease-control work, with which aspect alone this report deals.

In order to arouse interest in the work and to secure suitable plots for it, a series of meetings were held and addresses given by the three representatives of the Department above-mentioned, in which the aims of the work were stated, the improvement of the crop by selection and methods of cultivation discussed, and the chief potato-diseases illustrated by specimens and the measures for their control outlined. These meetings were held at Chilliwack, East Chilliwack, Atchelitz, Rosedale, Cloverdale, and Ladner. Offers of the required plots for carrying on the work were made and accepted at Chilliwack, Sardis, South Sumas, Surrey Centre, Kensington Prairie, and Sullivan. Later it was found necessary to discard the plots at Sullivan for spraying-work. The chief object from the standpoint of disease-control was to determine the best methods of preventing late blight. This disease almost every year causes great loss in the moist climate of the Lower Mainland, whilst spraying for its control has never been done. Under Eastern conditions, when the potato-bug, or Colorado beetle, begins to strip the plants when a few inches high, spraying has to be done early in the season for this pest, and the Bordeaux mixture to control blight can be combined with it at little extra cost. Under our conditions it was thought likely that spraying could be postponed satisfactorily until early in August. All the plots were carefully examined on July 16th and 17th and no trace of late blight was discovered. A little was found on July 29th at Chilliwack, and following the cold wet weather of August 14th, 15th, and 16th late blight developed rapidly. The following are the records for the individual plots. Figures as to comparative yields and keeping qualities of the sprayed and unsprayed plots are not yet available.

Surrey Centre.—The soil here was very light and peaty. The plants suffered a good deal from sun-scorch, and by August 7th, when the first spraying was made, early blight had proved unexpectedly severe. No late blight developed. Spraying had some effect in keeping the foliage green, but when the plot was last visited on September 27th practically everything was dead and the yield very light.

Kensington Prairie.—Early blight did not do anything like so much damage in this case as in the last owing to difference of location and better soil conditions. The crop was vigorous, there being a marked difference between the plots from selected and treated seed and adjoining plots which received no special care in this respect. Very little late blight developed, however, so that when last examined on September 27th there was little difference noticeable between the plot sprayed once and that sprayed twice. All sprayed plots contained fewer dead plants on this date than the unsprayed.

South Sumas.—A little late blight showed in a low spot in the field on July 29th. Plots were sprayed on August 2nd; examination on August 13th showed no spread on the sprayed plots, but a little on the unsprayed. On August 17th two of the three plots were sprayed again. On August 28th the sprayed plots were still in good condition, little difference being observed between that sprayed once and those sprayed twice; but there was a marked increase of late blight on the unsprayed portion, two spots being killed out. (*See* photograph.)

Sardis.—The ground here appeared to be in good condition and well drained, but was very much infested with horsetail, indicating the presence of a wet substratum. This horsetail helped to hold moisture that assisted the spread of blight, which was much more marked on these plots than on any other of the experimental ones. There were plenty of fields in the Chilliwack Valley, however, quite as bad as the unsprayed plot here. On July 29th there was little early blight or tip-burn and no late blight visible. On July 30th three plots were sprayed with 4-4-40

Showing the spot where blight started in the unsprayed plot at South Sumas. Note the dead stalks of the blighted plants.

View of the unsprayed plot at Sardis. All the plants are dead. The plots on each side of it received one spraying.

Bordeaux mixture. On August 13th the sprayed plots appeared in good condition, only a little late blight being found on close examination. On the unsprayed plot late blight was quite noticeable. On August 19th two plots were sprayed as before. On August 28th the plants on the unsprayed plot had turned completely black and many of the tubers were diseased. On one plant examined eight out of thirteen tubers were diseased. Tubers on all plants examined on sprayed plots were sound. One plot was sprayed again on this date. A final examination was made on September 6th. It was possible at this date to pick out clearly with the eye the line of demarcation between the four plots sprayed respectively three times, twice, once, and not at all, by the increasing amount of blight on them. The photograph shows the contrast between the plot sprayed once and that unsprayed. A measured rod on an average row of the unsprayed plot yielded 14 blighted tubers and 100 sound ones, 62 of marketable size and weighing 20 lb. A similar rod from the plot sprayed once yielded 96 tubers all sound, and the 70 marketable ones weighed 27 lb.

Chilliwack.—This plot was well in the open, not shaded by trees, and late blight only developed to a slight extent even on the unsprayed plots. In this field varietal differences were apparent, the unsprayed plot of Scottish Champion showing less blight than a plot of Dakota Red sprayed once.

While the work of the past season has been more or less of a preliminary nature, the following results have been gained:—

(1.) That late blight did not appear until August, and even one spraying gave a considerable degree of protection against it.

(2.) That dates of spraying cannot be determined with reference to late blight only, since early blight may be very destructive in seasons like the past. This could probably have been controlled in a good measure by earlier spraying.

(3.) The necessity of testing and comparing different types of sprayers, the mechanical aspect of spraying-work being the most unsatisfactory. The type of machine used, whilst fairly satisfactory for small areas, say up to 5 acres, would be too slow for a large acreage.

Weather Conditions and Disease.

In addition to the effects noted above on potato-diseases, the weather conditions during the past season were important in other directions. A good deal of this is due to the heavy rains which were pretty general over the Province about the middle of August following a hot, dry season. This resulted in a great deal of apple-scab, fruit-pit, and a very general condition of premature breaking-down of the tissue of apples. Some peculiar cases of rotting of apples in storage were called to my attention. These apples were of the variety Delicious, grown in the Vernon and Oyama Districts. Ordinarily, the climate at these points is too dry to permit of the development of apple-scab, except during the early part of the season. The moisture from the heavy August rains, however, had been able to collect and remain long enough in the stem end of the apples to bring about a general infection with scab in the cavity. The scab-spots varied from five to over twelve in each cavity and were very small and inconspicuous. Since the rest of the apple was free of scab, the fruit was very naturally packed as No. 1. Unfortunately, rot-fungi gained access through these scab-spots, with the result that a large percentage of the apples rotted in storage. Whilst the conditions which resulted thus might not occur again for some years, it emphasizes the value of spraying against scab. Technically, the case is of interest in that the rotting was not due to the usual causal fungus, but to another one which is being investigated further.

Codling-moth.

A number of supposed cases of codling-moth infestation having been reported during the last two years from New Westminster, considerable time was spent this fall in following them up. In all cases, however, the pest proved to be lesser apple-worm.

Field-work, etc.

A considerable amount of time has been spent, as usual, in the field with the different Horticulturists and Inspectors, inquiring into and advising regarding local disease problems. In addition to the routine work and correspondence of the laboratory, special attention has been given to the local movement of greater production. I gave two addresses on plant-diseases at the University in connection with the "Fight or Farm" course on garden farming, and have

paid over 200 visits in the vicinity of Vancouver, mostly in response to requests, to advise on pests and disease. Some work has also been done in getting data for the War Emergency Board of American Plant Pathologists.

EXHIBITIONS.

An exhibit of plant-diseases under the personal charge of the Plant Pathologist was shown at the Vancouver and Chilliwack Exhibitions.

CIRCULARS.

The following circulars were prepared and issued during the year: Spray Calendar for 1918; Diseases of Stone-fruits in British Columbia; Apple and Pear Scab; Potato-diseases; Apple-tree Anthracnose.

VERNON OFFICE.

During the past year R. C. Treherne, Field Officer of the Dominion Entomological Branch, has made his headquarters at the Vernon Laboratory. The services of M. H. Ruhmann, assistant to the Plant Pathologist, previously in charge of the Vernon Laboratory, have been placed, without reservation, at the disposal of Mr. Treherne for entomological work. The technical results of the work carried on will be published elsewhere, but a brief statement of the work done by Mr. Ruhmann is given herewith.

Observations were made and some experimental work done on codling-moth, onion-maggot, and climbing cutworms. Some very satisfactory results were obtained with the last-named pest. In one case 80 acres of land planted to tomatoes had suffered so badly that replanting was necessary. The area was treated with poisoned bait with such good results that upon replanting not a single plant on the whole 80 acres was lost.

Much of Mr. Ruhmann's time has been given to the work of improving the technical equipment of the laboratory. A large insectary has been erected on the Court-house grounds, the material for its construction having been furnished by the Dominion Entomological Branch. A first-class photographic enlarging-lantern has been purchased, which necessitated the rewiring of the laboratory. A large vertical camera-stand has been made. Many photographs have been taken of insect-injuries and life-histories. It is intended to use these instead of Riker mounts for exhibition purposes. The remainder of Mr. Ruhmann's time was given to supervising the breeding-cages in the insectary, collecting and caring for material.

In addition, exhibits were prepared and shown at the fall fairs at Kelowna, Armstrong, and Summerland, Mr. Ruhmann being in attendance to answer inquiries.

Respectfully submitted.

J. W. EASTHAM,
Provincial Plant Pathologist.

REPORT OF INSPECTOR OF IMPORTED FRUIT AND NURSERY STOCK.

W. H. LYNE.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—I have the honour to submit herewith my report of the work carried out by the Inspector of Imported Fruit and Nursery Stock, etc., and his staff of assistants during the year 1918.

STAFF.

The personnel of this Branch of the Department of Agriculture consists of your Inspector, three Assistant Inspectors, and clerk-stenographer stationed at Vancouver; also a Quarantine Officer at each of the following points of entry into the Province: Victoria, Nanaimo, Prince Rupert, Abbotsford, Huntingdon, Similkameen, Osoyoos, Bridesville, Midway, Grand Forks, Rossland, Waneta, Cascade, Kingsgate, Newgate, Cranbrook, Fernie, and Revelstoke. At Victoria the Quarantine Officer occasionally employs an assistant.

Customs Officers at Penticton, Osoyoos, Rykert, and Pacific Highway look out for any infested fruit or vegetables that may be brought across the boundary by way of wagon-road, only small quantities sufficient to accommodate the travellers on their journey being allowed. Larger quantities and consignments are admitted only at points of entry where regular Quarantine Officers are stationed.

It is the duty of the Quarantine Officer to inspect fruit, vegetables, rice, corn, peas, and beans coming into the Province, issue certificates, and collect inspection fees, which are paid into the general revenue fund of the Province.

Condemnation of Fruit, etc.

Imported fruit, vegetables, etc., found to be infested with any insect pest, or infested with any disease of sufficient importance to bar their entry into the Province, are shipped out by the most direct route or destroyed. The most important insect pests and diseases to which such radical treatment applies are: Codling-moth, San Jose scale, Mediterranean fruit-fly, potato-tuber moth, peach-worm, potato-canker or wart-disease, powdery scab, pea and bean weevil, and citrus brown-rot.

Cereal and Stored Products.

Imported rice, corn, peas, beans, etc., when infested with moth beetles or weevil, are either rejected, fumigated, or isolated, according to the extent or nature of the infestation. Special accommodation for fumigating such products is provided at Vancouver and Victoria.

New Quarantine Officer appointed.

In order to accommodate fruit entering the Province in commercial quantity by way of Osoyoos, Dr. G. S. Jermyn, Customs Officer, who had previously acted as temporary Quarantine Officer, was regularly appointed by your Inspector in November.

Work at Vancouver.

All nursery stock, trees, and shrubs coming into British Columbia, or entering Canada by way of British Columbia, have to come to Vancouver for inspection and fumigation. This work is carried out by the officers stationed at Vancouver, who are also responsible for the inspection of all other importations of horticultural or field products already referred to.

Vancouver Fumigating Station.

The building provided for the fumigation and inspection of imported nursery stock, trees, shrubs, and plants is also used to fumigate imported rice, corn, beans, peas, and many other consignments that are infested with objectionable insect pests from abroad. In addition to the regular officers stationed at Vancouver, a foreman and two or three men are employed at the fumigating station by the day whenever there is sufficient work to warrant extra help. These men are expert packers of nursery stock as the result of their having been engaged at that particular work when required during the last several years, and it is very fortunate for the Department that their other occupations permit them to come at short notice. Mr. Lane, the foreman, is almost regularly employed owing to the steady use of the buildings for fumigating imported cereals when the nursery stock season is closed, which is from May 1st to October 1st. The only repairs during the year were renewing the wagon-road and repairing roof of lean-to.

Victoria Fumigating Station.

As all the fumigation of imported nursery stock takes place at Vancouver, the accommodation at Victoria is only for the fumigation of imported cereals or stored products that may require such treatment at that port. On several occasions during recent years the one small building of 16 by 20 feet was not large enough to accommodate the demand, in spite of the fact that the Mount Royal Milling Company have a chamber on their own premises for fumigating the rice they import. There was considerable complaint from some of the importers last summer owing to this lack of accommodation, and your inspector was requested by the Hon. the Minister of Agriculture to make what arrangements might be necessary under the circumstances.

With a view to the best economy, it was decided to utilize a chamber, known as the hide-room, within a building at the Outer Wharf owned by R. P. Rithet & Co. The cost of preparing the chamber for efficient work was $550, the rent to be $150 per year, thus providing for an extra 100 tons capacity. Had the original plan of erecting a new building been carried out, the cost would have been $3,000, with a ground-rent of $100 per year.

The Mount Royal Milling Company increased their accommodation for fumigating imported rice by providing an extra chamber of 75 tons capacity in addition to the 100-ton capacity chamber they had already in use, thus proving their desire to keep their mill and premises free from infestation.

IMPORTERS REQUEST FUMIGATION.

One particular feature in connection with the large importation of rice, beans, peanuts, etc., from the Orient was the evident desire of several importers to have their consignments fumigated before placing in storage or forwarding to consignees who might object to the product being infested with weevil or moth. These men are beginning to realize the tremendous waste and individual loss resulting from insect pests in stored products.

AUSTRALIAN WHEAT.

The importation of wheat from Australia was an event of considerable interest, and also a demand on our ready recourse to deal with weevil with which it was infested. Previous to its arrival your inspector was notified that the Dominion Department of Agriculture requested a report of facilities at the Government elevator, Vancouver, for fumigating, superheating, or otherwise disinfecting wheat infested with weevil, in anticipation of the wheat coming from Australia being infested. Investigation proved that no special facilites for superheating or fumigation existed at the elevator or Government dock, other than that it was possible to fumigate wheat in the bins with carbon bisulphide, but just how large a quantity could be successfully treated in each bin was doubtful. Besides, sufficient carbon bisulphide could not be obtained on short notice. The Provincial Government fumigating chambers, already busy with other importations, could not handle such large shipments of wheat as were on the way within reasonable time to meet commercial requirements.

The first shipment of Australian wheat arrived from Sydney on August 21st ex the ship "Geraldene Wolvin," carrying a cargo of 1,562½ long tons in 22,000 sacks. This was landed at the Government dock and proved to be badly infested with weevil, quite a sprinkling of *Plodia* moth and *Tribolium* beetle, these insects being accompanied by several parasitic flies of the chalcid species.

As the whole consignment was en route to England, and the time for dealing with the infestation somewhat limited, it was decided to run the wheat through the fanning-machine into the Government elevator-bins, and from there load it in bulk into the S.S. "War Camp" conveying it to England. By this process practically all the adult weevil and other insects were separated from the wheat and carried with the screenings into a separate bin, where they were ultimately fumigated with carbon bisulphide. There were 36,730 lb. of screenings from the 1,562½ tons of wheat. They were a living mass of weevil, but the carbon-bisulphide treatment very successfully disposed of them all.

Sample of wheat taken September 18th after combing over the screens of the fanning-machine did not develop any new weevil until four weeks later, when a very small number of the adults began to appear, and continued to increase until December 31st, when they recorded 588 to 1 lb. of wheat. Most of the badly excavated grains of wheat were blown over the screens into the tailings, which process would no doubt dispose of many eggs and larvæ of the weevil. All the empty sacks, many of them swarming with weevil, were fumigated with carbon bisulphide at the Provincial Government Fumigating Station.

Between August 21st and December 17th there arrived at Vancouver from Sydney, Australia, two ship-loads of wheat in 48,109 sacks, weight 3,440 long tons; from Melbourne, Australia, three ship-loads in 106,543 sacks, weight 8,244 tons. One thousand eight hundred and seventy-eight tons from the Sydney shipment was divided between the Vancouver Milling & Grain Company and the Distillery at Sapperton, New Westminster. The balance of the Sydney and Melbourne shipments has gone to England in S.S. "War Camp" and S.S. "War Storm," with the exception of 4,881 tons that arrived at Vancouver on December 17th in the S.S. "Yankalilla" and is awaiting consignment.

SYDNEY WHEAT INFESTED.

All the wheat from Sydney, Australia, was considerably infested with weevil and treated similarly to the first shipment already described. This gave the Vancouver Milling Company the opportunity of grinding their wheat before the next batch of weevil had time to hatch out, which would be one month after the wheat went through the fanning-machine at the Government elevator.

MELBOURNE WHEAT FAIRLY CLEAN.

The wheat from Melbourne, Australia, was comparatively free from weevil-infestation, and apparently a very fair sample.

Cold-storage Experiments.

Several experiments have been made during the last few years to determine the best methods of dealing with infested stored products. One of our recent tests was commercial cold storage of imported rice infested with weevil, moth, and beetle. The result obtained was that the insects in the sacks of rice, piled so that the air could circulate among them, and exposed to 10 degrees below freezing, were killed after fourteen days' exposure to that temperature.

Superheating.

Exposure to 130° Fahr. resulted in death of all insects after three hours. This latter test, however, was made with small quantities only, and it is doubtful just how long an exposure would be necessary in connection with large amounts in bulk or sacks. Many rice-millers claim that heating rice spoils it for milling because the heat cracks the enamel of the grain, but they do not object to the cold storage.

Carbon Bisulphide.

Fumigating with carbon bisulphide, with a thirty-six-hour exposure, has proved to be the most effective and satisfactory method, provided the consignments were only a few hundred tons in weight and could be conveniently hauled to an air-tight chamber suitable for the operation.

Fumigation by Steam.

High-pressure steam gives excellent results as a means of disinfecting empty ship's holds or chambers that have recently contained badly infested stored products, and can be easily and safely applied.

Large Importations.

During the last year the exceptionally heavy consignments of rice, peanuts, etc., from the Orient have given us considerable trouble owing to a large proportion of them being infested with insect pests. Consignments very badly infested were fumigated with carbon bisulphide at the Government fumigating chambers. Other consignments only slightly infested, and too large to handle at the Government chambers within a reasonable time, were either placed in cold storage or isolated in cool warehouses that would become cold as the season advanced. This method avoided the infested product from coming in contact with the clean product and prevented further infestation.

Importation of Nursery Stock.

The tabulated list of imported nursery stock attached to this report gives the amount of stock imported in 1918 as compared to that of 1917. A glance at the respective figures shows very little variation with regard to the number of standard fruit-trees one year with the other, only amounting to 1,892 trees in favour of the year 1917, the same year also having an extra 752 nut-trees to its credit. Fruit seedlings and scions for 1918 were considerably in excess of the previous year, our British Columbia nurserymen preferring to propagate them instead of importing standard trees.

Embargo on Currant and Gooseberry Stock.

Small-fruit stock was well patronized, there being 10,000 more blackberry-bushes imported than the year before. In all probability currant and gooseberry stock would have shown quite an increase had it not been for the embargo prohibiting their entry into Canada.

The embargo which had been in force since July, 1917, was amended by Dominion Order in Council of June 6th, 1918, permitting the importation of gooseberry and currant stock from that part of the United States west of the line and excluding the States of Minnesota, Iowa, Missouri, Arkansas, and Louisiana.

Provincial Regulations.

Following a recommendation from the Dominion authorities and the approval of our Provincial Agricultural and Forestry Departments, the embargo on all five-leaved pine, gooseberry, and currant stock will in future include all such stock grown east of the Ontario western boundary. This will be a continuation of the line of demarcation running directly north and south through the United States, and is considered to be the western boundary of areas in

which the white-pine blister-rust is prevalent. The gooseberry and currant stock is associated with the white-pine blister-rust by acting as host-plant in the propagation of the spores of the disease.

ORNAMENTAL STOCK.

There was a marked increase in the importation of all ornamental trees, shrubs, and plants —a good indication that financial conditions are improving in British Columbia.

NURSERY STOCK CONDEMNED.

The percentage of standard fruit-trees condemned would average only about 3½ per cent., ranging from a fraction of 1 to 5 per cent. Small fruit and ornamental stock, with the exception of grape and gooseberry, did not run more than 3 per cent. for any one variety, and much lower on the average. The condemnation of grape stock amounted to about 17 per cent. owing to *Phylloxera* infestation, and gooseberry 9½ per cent. owing mostly to the embargo. Very little San Jose scale was in evidence as compared with many other years. Woolly aphis on apple-roots accounted for many of the trees being condemned.

Crown-borer, root-gall, anthracnose, sour sap, and *Lecanium*, *Aulacaspis*, *Diaspis*, *Chionaspis*, and *Ostræformis* scale-insects infecting and infesting the other varieties of stock resulted in their condemnation also.

A comparatively new insect during the last few years is a species of the woolly aphis attacking the roots of young pear-trees. It is presumed by some entomologists to be a European pear-aphis (*Eriosoma pyri*), and is even more destructive than the woolly apple-tree aphis. It often kills young pear-trees in a single season by consuming the tender fibre of the root-feeders. Quite a little of this aphis was found on pear-trees imported from Oregon, U.S.A., and the trees were condemned accordingly.

IMPORTED FRUIT AND VEGETABLES.

Another tabulated list accompanying this report gives the number and varieties of fruit, vegetables, etc., inspected at the several ports of entry into the Province, as compared to the previous year. This shows an increase in the number of apples, apricots, Japanese oranges, and grapefruit imported during the year 1918. California oranges were less than half the quantity of the previous year. There was a very large increase in the number of potatoes imported. These were practically all for the evaporators at New Westminster, Vancouver, Kelowna, Vernon, Sardis, and Chilliwack. New Westminster was by far the heaviest importer. Only 132 tons of potatoes from the United States and 82 crates from the Orient were for British Columbia consumption or open market.

FRUIT, ETC., CONDEMNED.

The condemnation of apples and pears was more extensive than the previous year, for which codling-moth was mostly responsible. There were very few peaches or apricots condemned for their old enemy, the peach-worm. Japanese oranges were remarkably free from scale-insects, resulting in very few being condemned.

PRODUCTS FUMIGATED.

Several cases of nutmegs from Singapore were simply alive with weevil, and after being fumigated were refused entry owing to the nuts being so badly excavated and filled with the castings of the insects as to render them totally undesirable for grinding and afterwards being used as spice to sprinkle on all kinds of puddings or custards.

This particular weevil infesting the nutmeg is of considerable economic interest owing to its being apparently a member of the *Bruchus* family and related to the pea and bean weevils, and deserves very close attention.

All peas and beans are very closely inspected upon their arrival from points outside the Province, and if infested with weevil (*Bruchus pisorum* or *fabæ*) are thoroughly fumigated with carbon bisulphide. Many tons from the Orient and some from the United States have been thus treated.

Other products fumigated were Oriental rice infested with rice-weevil, *Plodia* worm, and other larvæ, and beetle; peanuts mostly infested with *Plodia* worm. Several bales of rabbit-skins from Australia infested with *Larder* beetle were fumigated by request before going into bonded warehouse, where they were to be held for New York consignee.

Vancouver Office.

The Vancouver office, the headquarters of your Inspector, is situated in the Court-house. Reports from all outside Quarantine Officers are first forwarded to this office, where they are recorded and filed. The Form J, with duplicate certificates and individual compensation vouchers, are then sent on to Victoria to be audited and filed. All other details referring to the work of inspecting the several horticultural and field products imported into the Province are recorded in their proper order.

Specimens of insects and plant-diseases are received for identification and information given regarding them. Information on horticultural subjects is given by letter and interview.

Over 1,000 bulletins on miscellaneous subjects were given out on application during the year. All applications for information regarding the several subjects, including importation of fruit, nursery stock, and other horticultural and field products, receive prompt and courteous attention. For the year 1918 there were 613 letters received and 737 sent out.

J. W. Eastham, Provincial Plant Pathologist, shares the office with your Inspector and Vancouver staff, part of the office being equipped as a laboratory for his use.

All my assistants performed their work conscientiously and thoroughly, and I am proud to be the head of such a trustworthy staff.

Respectfully submitted.

W. H. Lyne,
Inspector of Imported Fruit and Nursery Stock.

REPORT OF DAIRY INSTRUCTOR AND INSPECTOR.

T. A. F. Wiancko.

W. T. McDonald, Esq.,
Live Stock Commissioner, Department of Agriculture, Victoria, B.C.

Sir,—I beg to submit herewith my report as Dairy Instructor and Inspector for the year 1918.

General.

A reasonably healthy condition has prevailed in the dairy industry of the Province during the past year, and it is confidently expected that when full reports are to hand a small increase in total dairy production will be noted. Weather conditions during the winter were favourable for milk production. The spring was, however, very cold and backward, making necessary the feeding of the cows in the stable much longer than is usual owing to lack of early pasture. This was almost immediately followed by a prolonged period of drought during the summer months, which seriously curtailed the summer milk production. Hay and fodder crops were seriously shortened, and at this time it seemed that there would be a great shortage of winter feed. Farmers in some districts sold off many of their dairy cattle or went out of the business altogether, thinking that it would be more profitable to sell their crops at high prices than to feed them for milk production. August rains, however, improved growth to such an extent that second crops were secured in many cases. Pastures improved greatly and corn and root-crops resulted in abundant yields. A fine, mild autumn further helped to relieve the feed situation, and as a result dairy cattle are going into the present winter with a reasonable supply of the rougher dairy feeds. Mill-feeds, owing to war conditions, are still very scarce and high-priced, and until this phase of the feed problem becomes normal, feeding for heaviest milk production will not be followed.

The labour problem has continued to be a serious one for the dairy-farmer, and early in the year, owing to conscription, many young men were called from the dairy-farms and could not be replaced by competent hands at any reasonable wage. This condition made it extremely difficult for the farmer to carry on as he knew he should do in order to increase production for war needs. Too much praise, however, cannot be given these dairymen, who in the face of such heavy odds, and in spite of small profits, kept our great dairy industry from going behind.

Prices for Dairy Products.

Butter prices during 1918 throughout the Province have ranged about 10 per cent. higher than during the previous year, and have resulted in returns to the producer of cream more

reasonably commensurate with the higher prices of feed and labour. Cheese prices ranging from 25 to 27 cents wholesale have made it possible to produce a quantity of cheese in competition with cream for butter-making.

Milk prices for city consumption have also ranged somewhat higher than in the previous year, and on the Lower Mainland owing to curtailment of the output of the milk-condenseries, a great deal of milk that previously went into evaporated-milk manufacture was converted into butter and cheese. For this reason, also, it will be found, when returns are complete, that the output of butter and cheese has largely increased, but at the expense of the output of the evaporated product.

CREAMERIES.

The regular inspection of creameries has secured as much attention as time would allow, and the majority of them were visited at least twice during the year.

No new creameries have been established during the year. The Cranbrook Creamery was closed owing chiefly to the lack of cream for butter-making. It is hoped, however, that it will be reopened in the near future with renewed vigour and with a greater chance for permanent success.

A further number of the existing creameries have installed improved pasteurizing apparatus and other needed equipment. Sanitary conditions at the creameries and condenseries were found to be quite satisfactory.

Continued improvement in the quality of British Columbia creamery butter has been noted, and it is a source of great satisfaction to note that at some of the most important dairy exhibitions, both in British Columbia and Alberta, our butter-makers have won some of the best prizes.

Butter-makers have continued to evince a keener interest in their work and have shown a greater desire to improve. A system of cream-grading with payments according to quality is being followed with very beneficial results in a number of our best creameries, and it is safe to say that such a system will soon become general.

In order to render assistance in the improvement in quality, flavour, and workmanship in British Columbia creamery butter, the British Columbia Dairymen's Association, of which your Dairy Instructor is Secretary-Treasurer, arranged for a season's butter competition which would extend over a period of five months. The competition was open to all British Columbia creameries, and entries consisted of one 14-lb. box of butter, solid packed, salted, to be made between the 1st and 15th of each month and sent to cold storage as directed by the Secretary, not later than the 20th of the month, to be held there until judged at the end of the season. The object of extending the competition over a number of months was to ascertain the relative keeping qualities of the butter put up during the different months of the season and in the different creameries. Detailed records of each churning of butter from which the exhibits of butter were made were kept for the purpose of reference and comparison, and these in themselves are of considerable educational value to the creamery-men, in that it affords an opportunity to study the methods of the successful competitors.

Altogether eleven creameries participated in the competition, and in order to make it interesting a generous prize-list was arranged. Generous aid in this connection was given the association by members of the wholesale produce trade and dairy-supply houses in the way of cash and special prizes. The association undertook to meet all expenses of the competition, as well as provide championship prizes for the competitors who would make the highest average scores for the whole season.

A butter-judging competition, to be participated in by the several competitors, was also arranged to take place at the close of the competition, and a generous prize-list for this was also arranged. This competition was of great educational value, in that it granted the competitors an opportunity of comparing their skill as butter-judges with that of the official judge. A competition of this kind tends to fix uniform grade standards for butter according to present-day market requirements in British Columbia.

C. Marker, Dairy Commissioner of Alberta, who is considered one of the best butter-judges in Canada, placed the awards and was present to answer questions and give advice. The quality of the butter, he said, was a credit to the makers, and a good deal of it was good enough to win honours in any of the largest exhibitions or competitions in Canada. He was very pleased to note a very great improvement in the quality of British Columbia creamery butter, more par-

ticularly during the past two years. This was brought about largely by improved methods of pasteurization and more careful cream-selection. Cream must be pasteurized to a temperature of at least 170° Fahr., and held for at least ten minutes at that temperature before cooling, in order to ensure keeping quality in the butter. By this method it is possible to make butter which will conform to a uniform standard at all times, regardless of the period of the year.

A list of the prize-winners in the season's competition and butter-judging competition is given in Appendix No. 9.

A large number of inquiries have, as in former years, been received regarding the establishing of new creameries in new districts. This would indicate that the number of dairy cows are increasing in certain districts to the point where the manufacture and sale of dairy butter is becoming an increasingly difficult problem. This is particularly true in several districts along the Grand Trunk Pacific and Pacific Great Eastern Railroads, and it is hoped that very soon creameries will be established in these sections, either by private enterprise or by co-operation with Government assistance.

A list of the active creameries, condenseries, and cheese-factories of the Province is given in Appendix No. 10; also a summary of creamery report for the year 1918 in Appendix No. 11.

Cheese-making.

During the year the Ferrara Cheese Company, Limited, Chilliwack, continued the manufacture of fancy cheese of several varieties with an increased output. The Revelstoke Creamery continued the manufacture of cheese in sufficient quantity to supply the local demand.

In the early spring the Fraser Valley Milk Producers' Association found themselves with a considerable quantity of surplus milk on hand owing to the decrease in the demand for evaporated milk. The old Eden Bank Creamery at Sardis was fitted up as a cheese-factory, and a Cheddar cheese of excellent quality was made during the summer season. The season's output amounted to 212,000 lb.

City Dairies.

Milk-distributing plants, particularly in the larger towns and cities, are in a good sanitary condition, and continue to show improvement in the way of new and up-to-date equipment and facilities for the rapid handling of milk.

Much discussion and controversy has taken place in the City of Vancouver in the past year or two regarding the feasibility of amalgamating the present distributing dairies into one large organization for the whole city, in order to eliminate the waste due to duplication and multiplication of milk routes, and the consequent excessive overhead charges connected with the present system. That some such scheme will shortly be successfully worked out is evident by the earnest manner in which both the producers and city people are at present considering the whole matter. The result should mean a reduction in the price of milk to the consumer, as well as allowing a greater margin of profit to the producer.

Cow-testing Associations.

The work of the Cow-testing Associations at Comox, Langley-Surrey, and Ladner has been carried on with very gratifying results during the past year. At Chilliwack the work has suffered somewhat owing to the difficulty experienced in securing a permanent and efficient tester in place of one who resigned to engage in other work. During the last half of the year, however, the work has proceeded with much of its former enthusiasm.

The Test Supervisors of the several associations are giving their best efforts to the work, and as time goes on the members of the testing associations are realizing to a greater extent the value and benefit of dairy records. The dairy-farmer is coming to a realization of the fact that with abnormally high prices for all dairy feeds, and with high labour costs, it becomes more and more necessary that only the best cows are kept in the herd, and that progeny from the best cows only be raised for future breeding.

As in former years, cash prizes were awarded by the British Columbia Dairymen's Association for the three cows in each class producing the highest amounts of butter-fat in each of the several Cow-testing Associations. Appendix No. 12 gives a list of the winners for 1918, and shows a very gratifying increase in average fat production over the former year.

OFFICIAL TESTS.

As in previous years, testers are being supplied for Holstein-Friesian Record of Merit tests, and during the year such tests have been carried on at Colony Farm, Essondale; Experimental Farm, Agassiz; and at the farm of J. M. Steves, Steveston.

A new official record of 21,161.8 lb. milk and 704.652 lb. butter-fat for yearly production in the junior two-year-old class was completed during the year by the remarkable heifer, "Colony Aaggie Pietertje," owned by the Colony Farm.

The following table shows her monthly production throughout the year:—

"Colony Aaggie Pietertje," No. 38774, C.H.F.H.B.

	Milk, Lb.	Fat, Lb.
October 21st, 1917, to November 19th	1,800.8	59.165
November 20th to December 19th	1,953.5	62.674
December 20th to January 18th, 1918	2,127.8	73.205
January 19th to February 17th	2,001.8	70.121
February 18th to March 19th	1,888.7	62.635
March 20th to April 18th	1,787.0	55.787
April 19th to May 18th	1,641.6	55.708
May 19th to June 17th	1,718.6	56.955
June 18th to July 17th	1,674.4	55.343
July 18th to August 16th	1,466.6	50.570
August 15th to September 15th	1,407.8	46.712
September 16th to October 15th	1,429.4	47.446
October 16th to October 20th (5 days)	263.8	9.331
Total, 365 days	21,161.8	704.652

This record entitles "Colony Aaggie Pietertje" to be placed as: (1) The only two-year-old heifer in Canada with a strictly official yearly record above 20,000 lb. milk and 700 lb. butter-fat; (2) the Canadian champion junior two-year-old for the production of either milk or butter-fat in one year; (3) the world's champion junior two-year-old official test for one year.

CANADIAN NATIONAL RECORD OF PERFORMANCE.

Testing under the supervision of the Dominion Live Stock Branch in the Canadian National Record of Performance has received hearty support by British Columbia breeders of pure-bred dairy cattle during the past year, and many noteworthy records have been made by British Columbia cows. Lack of space forbids mention of them at this time. A total of sixty-two dairymen have had cows entered during 1918, as against fifty-six and forty-four in the years 1917 and 1918 respectively.

"DAIRIES REGULATION ACT."

Testers' Licences.—The licensing of milk-testers under the "Dairies Regulation Act" has been continued under the supervision of the Dairy Division. During the year twenty-two candidates came forward for examination and have qualified for licences. A list of testers licensed during 1918 is given in Appendix No. 13.

Dairy and Creamery Licences.—Dairy and creamery licences were issued to forty-four persons and firms buying milk and cream from the farmers in the Province on the basis of the butter-fat contained therein. A list of dairies and creameries licensed under the Act in 1918 is given in Appendix No. 14.

OFFICIAL MILK-TESTERS.

J. B. Watson, Sardis, and E. Rive, Vancouver, official milk-testers appointed under the provision of the "Dairies Regulation Act," have continued to render efficient services during the year in determining butter-fat tests of milk and cream, checking up weights and tests, etc., for both producers and purchasers.

BRITISH COLUMBIA DAIRYMEN'S ASSOCIATION.

The British Columbia Dairymen's Association has enjoyed a very successful year during 1918. The membership roll now stands at 353, representing an increase of eighty members over the previous year.

The annual convention was held in Chilliwack on February 6th and 7th, and was one of the most largely attended ever held by the association.

The twelfth annual report of the association was prepared and published. This includes a full statement of the affairs and finances of the association and is supplied to all the members.

Fall Fairs.

During the season of fall fairs assistance was given at the following fairs in judging dairy products or dairy cattle: Vancouver, Chilliwack, Cowichan, Kelowna, Comox, and Saanich.

Dominion Dairy Conference.

On the invitation of the Hon. T. A. Crerar, Dominion Minister of Agriculture, your Dairy Instructor attended the Dominion Dairy Conference at Ottawa, November 25th to 28th, inclusive. This Conference was of national scope, since it was made up of delegates representing all branches of the dairy industry in all the Provinces, including the producers. Some fifty-odd delegates in all were present.

Some of the outstanding accomplishments of the Conference may be briefly summarized as follows:—

(1.) A number of important changes were suggested in the legal standards for dairy products as used by the Department of Inland Revenue. These apply to milk, cream, homogenized milk, homogenized cream, condensed and evaporated milk, sterilized milk, butter, and cheese.

(2.) Scales of points were adopted for scoring cheese and butter, which it is proposed shall be used throughout Canada. Grade standards and grade descriptions of cream were also adopted.

(3.) The pasteurization of milk or cream in the manufacture of all butter made in Canada was recommended.

(4.) As a means of helping to prevent the rapid spread of tuberculosis among swine, the Dominion Government will be requested to make it compulsory to pasteurize all dairy-factory by-products.

(5.) A Dominion-wide organization, embracing all interests of the dairy industry, and to be known as the National Dairy Council, was formed, and for which officers were duly elected and preliminary expenses provided for.

Office-work.

There has been a largely increased amount of correspondence during the year. A large number of inquiries were received and answered on matters connected with dairying in the Province in general, and the administration of the "Dairies Regulation Act" has added a considerable amount of office-work.

Respectfully submitted.

T. A. F. Wiancko,
Provincial Dairy Instructor and Inspector.

REPORT OF SOIL AND CROP DIVISION.

E. W. Hogan, B.S.A.

W. T. McDonald, Esq.,
Live Stock Commissioner and Acting Deputy Minister,
Department of Agriculture, Victoria, B.C.

Sir,—I have the honour to submit herewith the annual report of the Soil and Crop Division for the year ending December 31st, 1918.

Demonstration Stations.

As announced in the annual report for 1917, the only demonstration station operated under the direction of this Division is that located at Pitt Meadows. Work on those situated at Armstrong, Chilliwack, Edgewood, Grand Forks, Rock Creek, Rose Hill, and Errington was terminated at the end of last season.

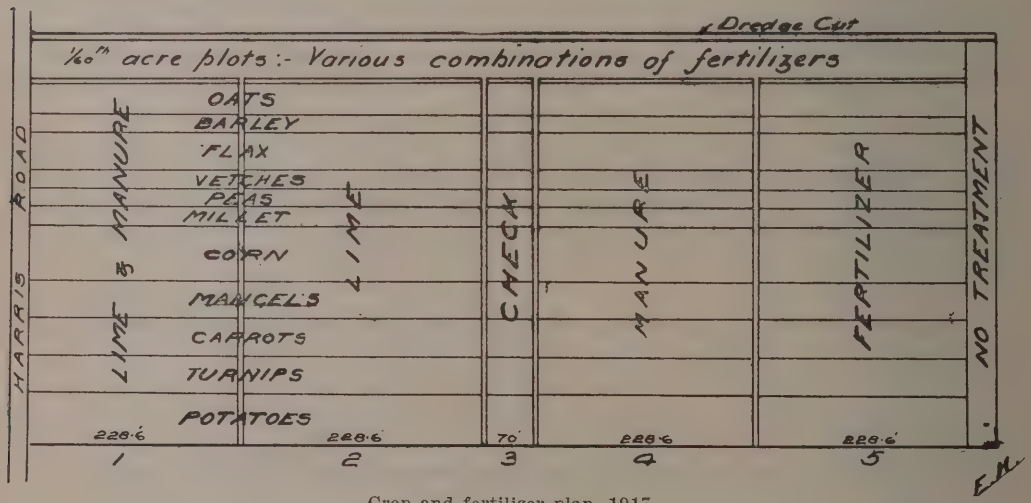
The demonstration farm at Pitt Meadows is located on the farm of F. V. Harris. The surface soil is of vegetative origin, partly decayed, and averages in depth about 18 inches; the subsoil is a silty clay. It is representative of a block of land, about 13,000 acres in area, lying between the Pitt and Fraser Rivers. All this area was at one time flooded by the high water

from these rivers, but about the year 1894 dykes were built around the rivers, dredge-cuts put through the district, and pumping-stations to lift the water, conducted by the dredge-cuts to the dykes, over the dykes into the river. However, even with this safeguard, development has been very slow. All the land needs drainage before successful results can be obtained from it.

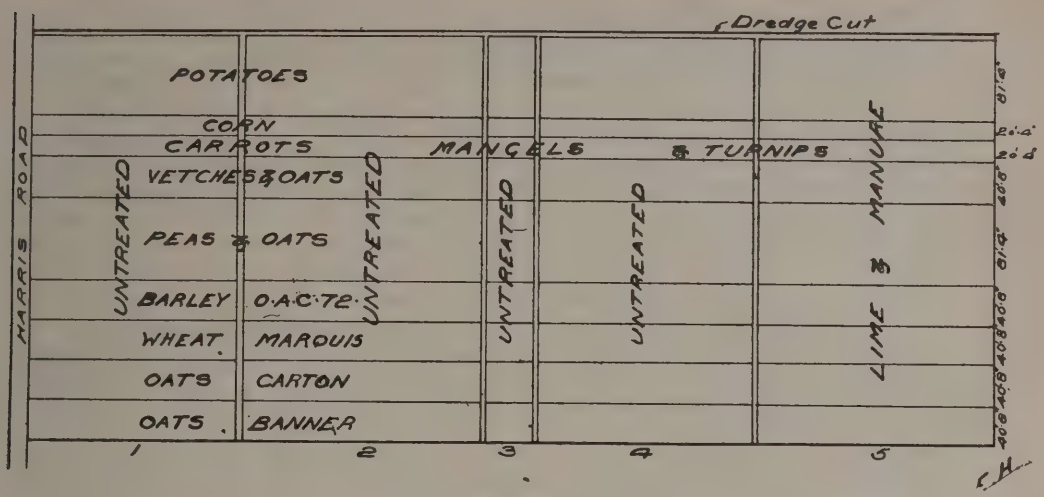
In the season of 1916 the plot of 10 acres was taken over on the Harris Farm, a system of tile drains installed, and work carried on as described in last year's report. In January and February of 1918 all the plot was flooded for weeks by thaws, bringing water down from the mountains behind the Meadows. Large fence-posts were floating over the field; yet within a few weeks of the flood receding the land was ploughed, showing the efficiency of the tile drains in removing excess water. It should be pointed out that the outlet of the tiles is into the dredge-cut; when the latter is running full, drainage of the land automatically ceases. Therefore, to have complete drainage of this area, the pumps emptying the dredge-cuts must be capable and made to keep the dredge-cuts no more than one-third full. Also, more dredge-cuts are necessary to supply outlets for all the area affected. There is not an acre of this area that will not amply repay expense of reclamation.

In the season of 1918 the work conducted on this plot was less of an experimental nature than in 1917. The crops grown were such as would be needed by a farmer running a full complement of farm animals. Satisfactory results were obtained along this line. In conjunction with this, fertilization of a nature within the reach of any real farmer was practised. Barnyard manure at the rate of 20 tons per acre was applied to those portions that were not manured in 1917. Lime was applied, 1½ tons per acre, to areas not receiving any in previous season. The applications were put on in such a way that information was obtained as to the effect of each of those fertilizers in the season applied *versus* effects carried into following season. No commercial fertilizer was used as the extensive tests of 1917 showed negative results.

The following charts show the way the 10 acres was divided, fertilized, and cropped in the seasons of 1917 and 1918:—



Crop and fertilizer plan, 1917.



Crop and fertilizer plan, 1918.

The following table gives the results obtained in 1918 with the various crops:—

Table 1.—Treatment, 1917 and 1918, and Crop Results in 1918.

Crop.	A. Lime, 1½ tons; Manure, 20 tons, Spring of 1917.		B. Lime, 1½ tons, Spring of 1917.		C. Check. No Lime or Manure.		D. Manure, 20 tons, in Spring of 1917.		E. Fertilizer in Spring of 1917, No Results. Lime, 1½ tons; Manure, 20 tons, in Spring of 1918.	
	Yield per Acre.		Yield per Acre.		Yield per Acre.		Yield per Acre.		Yield per Acre.	
	Tons	lb.	Tons	lb.	Tons	lb.	Tons	lb.	Tons	lb.
Peas and oats for hay	4	1,650	3	0	2	251	4	1,265	5	900
Vetches and oats for hay	4	393	3	0	2	142	4	720	4	1,156
Garton oats	0	1,804	1	247	1	122	1	9	1	258
Banner oats	0	1,481	0	1,663	0	1,633	0	1,720	1	133
Wheat, Marquis	0	1.336	0	1,588	..	....	0	705	0	1,284
Barley	0	1,518	0	1,210	..	....	0	415	0	733
Corn	12	829	7	810	3	1,405	8	1,424	6	1,068
Carrots	..	....	..	....	..	....	..	....	..	....
Mangels	..	....	..	....	..	....	..	....	..	....
Turnips	..	....	..	....	..	....	..	....	..	....
Potatoes	..	....	..	....	..	....	..	....	..	....

* NOTE.—Yield so small they were threshed together. On Plot A lodging of the oats caused a decreased yield.

With hardly an exception, the results all show that barnyard manure gives better results than lime or fertilizer, but applications of lime also bring profitable returns. It is satisfactory to know the treatment most beneficial is one within the reach of every farmer. Manure being needed does not mean, in this case, that the soil is a poor one. The reverse is true, but the soil is a dormant one. Being flooded for perhaps ages, organisms causing decay and nutrification are not present, or at least not in sufficient quantities, and the only practicable means of seeding the soil with these organisms is by applying manure. It seeds the soil with the bacteria necessary to unlock the store of plant-food and renders it available for use of growing crops.

Two seasons is too short a time in experimental work to base conclusions on, but results have been such as to justify the following deductions:—

(1.) Drainage is absolutely essential.

(2.) That applications of barnyard manure, coupled with good tillage, is the best treatment that can be given. Lime can profitably be applied.

(3.) Forage, silage-crops, and grain-crops under the above treatment can be grown quite successfully.

(4.) This points out that for ultimate success as large a part of the crops grown as possible must be returned to the land in the form of manure. This again means keeping of cattle and swine and selling little or no unfinished products.

DEPARTMENT CLOVER AND BEAN THRESHER.

The clover and alfalfa huller owned by the Department was operated in the Armstrong District. After threshing what clover and alfalfa crops had been grown for seed it was fitted with attachments for threshing beans. It gave fair satisfaction at this work and threshed a large acreage of beans in the Vernon, Oyama, and Kelowna Districts.

FIELD-CROP COMPETITIONS.

In the bulletin, published in April, 1918, giving the results of the field-crop competitions for 1917 one change was made in the regulations for 1918 competitions. The number of entries necessary for a competition was increased from eight to ten. This had the effect of decreasing the number of competitions.

Competitions were conducted by thirty institutes, with forty-eight competitions and 510 entries. The crops used were as follows:—

Kind of Crop.	No. of Competitions.
Potatoes	27
Oats	7
Wheat	6
Grain-hay	4
Mangels	1
Carrots	1
Corn	1
Beans	1

It seems as if this line of work was not bringing about the improvement of seed that might be expected. In too many cases the competitors enter the competition as a matter of course, or to oblige the Secretary of the institute. There are many exceptions to this, and some men could be mentioned who through this work have become consistently careful seed-growers. In every case the crops on their farms give striking evidence of what may be done by selection of seed and use of a seed-plot.

Officials of the Horticultural Division assisted the members of the Soil and Crop Division in the judging of the competitions, and through their aid no extra judges were employed.

PROVINCIAL SEED COMPETITIONS.

During the season of 1918 competitions in seed-growing, in which any member of a Farmers' Institute without action of his institute could compete, were carried on. The classes included crops not listed in the field-crop competitions—i.e., mangel-seed, carrot-seed, and like crops. As root- and vegetable-seed growing is yet only carried on in a small way, the classes were not very well filled. Some excellent entries of different crops were scored, and it seems reasonable to believe competitions in small-seed crops can be made a useful way for information to be carried to the individual grower by the men doing the judging.

SEED FAIRS.

The seed fairs, usually held in December, had to be postponed until January, 1919, on account of the Spanish influenza epidemic.

CO-OPERATIVE VARIETY TESTING.

This work was continued in the present season, but in different lines. Very little seed was sent out by this Division, but the men who received seed in the spring of 1917 and had good results were asked to supply neighbours with small samples of the varieties they had. In this way the number of co-operators was increased with very little cost. The reports on results obtained are not all received yet, and, as the work of compiling these is considerable, it will be impossible to give a synopsis of results in this report.

Experimental Work in Control of Late Blight on Potatoes.

Late blight of potatoes is present every season in the Lower Fraser Valley, and in many seasons causes great loss to growers of this crop. In the season of 1917 it was very prevalent, and the loss by rot, due to the fungus of this disease, was in many cases over 50 per cent. of the stored tubers. This was in addition to the loss in the fields before harvesting.

For the purpose of demonstrating to the growers that this disease could be controlled by spraying the growing plants with Bordeaux mixture, a series of experiments were undertaken by this Division, advised and assisted by J. W. Eastham, Plant Pathologist. Plots were selected at Chilliwack, Sardis, and Atchelitz, as representative of the district lying east of the Vedder Mountain. Four plots were selected in the Cloverdale and Surrey Centre Districts, representative of a large district where blight is usually prevalent.

The results obtained were variable. On some plots no late blight appeared, and therefore the results were negative. In general, spraying was not started early enough in the season. On the plots in the Chilliwack District conclusive evidence was obtained that spraying is effective in combating the disease. Potatoes in the sprayed portions of the plots were green and vigorous when the unsprayed plants were blackened and killed by the blight. A detailed account of these experiments will be found in the report of the Plant Pathologist.

It is hoped that, with one season's experience as a guide, much better results will be obtained in the seasons to come. This season's work has brought out evidence that will be of great value in future experiments.

Meetings and other Work.

A series of meetings were held in the Fraser Valley and addressed by officials of this Division. The subjects were "Potato-growing" and "Control of Potato-diseases." Other meetings were addressed in different parts of the Province in response to invitations from institutes. At thirteen of the fall fairs members of this Division acted as judges and rendered what assistance they could to the management.

A very important feature of the work of this Division is one that no estimate in figures or of results obtained can be given—namely, farm visits. During spring and summer months and in all parts of the Province many farmers are visited, local and personal problems discussed, and, it is believed, only in this way can much assistance be rendered.

Respectfully submitted.

Everett Hogan,
Soil and Crop Instructor.

REPORT OF CHIEF VETERINARY INSPECTOR.

Dr. A. Knight, V.S.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

Sir,—I beg to submit the report of the Veterinary Division for the year from January 1st to December 31st, 1918.

During the year, besides attending to contagious diseases among domestic live stock, some little time has been devoted to examination and prescribing for stock-owners in the outlying districts where it was impossible to obtain a veterinarian. The owners of stock appreciated this movement on the part of the Department.

Influenza.

This disease has been prevalent among horses, more especially on the Mainland. A number of the Provincial Inspectors were requested to demonstrate the application of the serum treatment as a preventive measure. I am not in a position to say to what extent this treatment has been beneficial in preventing the spread of this trouble. Some report good results; others again, thought it was of little avail. Only by keeping such animals that have been treated under observation can one demonstrate the effectiveness of this treatment.

This disease was not in such a severe form as last year, and very few fatalities, the after effects of this disease causing most of the deaths. Some disease affecting horses was reported from the Alberni District. Upon investigation the trouble was found to be primarily due to coarse and indigestible fodder, which the animals were obliged to subsist on, causing digestive troubles. The ground where the animals were obliged to pasture was very low. By the removal of horses from such conditions no further trouble was reported.

INTERNAL PARASITES AMONG SHEEP.

During the year several cases of losses among sheep were reported. Upon investigation stomach-worm (*Hæmonchus contortus*) was found to be the cause. In infested animals these worms are found in the fourth stomach. The parasites are from ½ to 1½ inches in length. Sheep, goats, cattle, and other ruminants are found infested with it. Stock grazing on pastures over which infested animals have run usually become affected. Moisture favours the development of the embryos.

Low ground should be drained if used for pasture. Burning over the pasture will destroy most of the young worms on the ground and grass. Animals should be changed to fresh pasture as often as possible, and a plentiful supply of salt should be kept for the flock at all times. The administration of copper sulphate is found to be effective. By taking 2 oz. and dissolving this in a gallon of water, lambs six months to one year are given 2 oz. of solution; mature sheep, 2½ to 4 oz. of solution.

RABBITS.

Several reports were received regarding fatalities among rabbits. Severe losses occurred among several breeders. On post-mortem the intestinal tract showed bacterial infection. Treatment was advised and a thorough disinfecting of hutches and premises. This checked the trouble and the losses have been greatly reduced. This infectious disease gave every indication of causing heavy losses amongst those engaged in raising fancy stock, and, if not dealt with promptly, no doubt would have entailed heavy financial loss among those engaged in the industry.

ENTOZOA IN CATTLE.

Cattle pastured on low or swampy ground are more liable to become infested with various forms of internal parasites, such as worms in the lungs or bronchi and producing verminous bronchitis. Young stock are more usually affected; also cattle on such lands are more liable to intestinal parasites. A number of these cases have been dealt with during the year. Preventive measures were advised and treatment given. By adopting prompt measures very few fatalities occurred, yet considerable financial loss is incurred through loss of flesh and rendering the animals unfit for beef, also greatly diminishing the milk-supply of dairy cattle and impairing the growth of young stock.

Tapeworm was also found. I may mention one herd which had been a financial loss to the owner for a number of years. One of the younger animals was destroyed, and on post-mortem tapeworm was found in the intestinal tract. All the animals in the herd exhibited the same symptoms in some degree. After adopting treatment as advised the herd is now on a profit-producing basis and the owner appreciates the assistance rendered by the Department.

PLANT-POISONING.

From time to time cases of poisoning are reported, evidently from plants. The most common is due, no doubt, to water-hemlock. Samples of the supposed source of poisonings have been sent to the Department and identified as such. As the poison in this plant is very active, medical remedies are of little avail, except when administered immediately the animal has eaten of the plant. The general advice is to keep stock off the ground where these plants are prevalent; plants can be dug up or fenced off, as the area where these plants grow is usually localized. Although we have other poisonous plants in British Columbia, these are apparently causing very little loss of stock. A number of farmers have reported losses of pigs which were apparently caused through feeds that were purchased. In two cases the feed appeared to contain large quantities of mustard-seed. No doubt the screenings from mills ground up and mixed with other refuse. Mustard-seeds contain active poisons, and these probably account for the losses among swine. The moral would point to avoid purchasing cheap feeds without first knowing the ingredients.

Goitre.

Goitre among swine and other domestic stock has proved a handicap to stock-raising in some parts of the Province. The iodine treatment, I believe, is proving effective in relieving this condition. If the dam is fed with this drug during her gestation period the offspring are born in most cases normal and thrive after birth. So far the iodine treatment has been tried almost exclusively on sows. I would recommend that an opportunity be offered to extend the experiment to breeding mares, usually in those sections where we have such large losses among new-born foals.

Hæmorrhagic Septicæmia.

Although several outbreaks of this fatal malady were experienced in 1917, only one outbreak of this trouble was found during the past year and confined to one animal. As is usually the case with this disease, this animal was found on low-lying pasture. As reported last year, preventive measures can only be adopted by keeping animals off these infested spots.

Actinomycosis.

Only two cases were reported during the past year, and these were disposed of by consent of the owners, as the cases were beyond treatment.

Tuberculosis.

During the year 1,907 premises were visited and 15,705 head of cattle were tuberculin-tested; 568 reactors were found, the Inspectors covering ground that was not tested over in 1917. Considerable time is taken and expense incurred in testing for parties with one or two cows. Very little, if any, milk is sold by these parties. A good deal of this testing in small herds is carried out at the request of the city health authorities, and also by written or verbal requests from the owners themselves. Reported cases of tuberculosis have also been received from settlers in isolated districts. Much time is taken up with this work and an outlay of expense incurred out of proportion to our regular testing operations.

On Vancouver Island there have been 514 premises visited; 4,314 head of cattle tested; 184 reactors. On the Lower Mainland or Fraser Valley, 1,157 premises visited; 9,683 head of cattle tested; 356 reactors. In the Upper Country, including the Okanagan, Kootenay District, and Columbia Valley, 482 premises visited; 1,762 head of cattle tested; 32 reactors.

In the Lower Fraser Valley the testing for tuberculosis was confined there largely to those herds where tuberculosis had been found in previous years, the owners and the Department wishing to clean up these herds. In certain sections in this district the percentage of reactors in some herds was found in 1914 to run about 51 per cent. The percentage of reactors in these same sections has now been reduced to about 5 per cent., and in a number of herds where the disease was so prevalent they can now show a clean bill of health. The Okanagan Valley is now practically free from this disease. Covering 161 premises visited, 657 cattle tested, only four reactors were found.

Sanitation of Stables and Dairies.

The Inspectors report a steady improvement in the sanitary conditions of the stables and dairies. The utensils used in connection with the dairy have been found, on the whole, in good condition. The older dairies where milk has been stored are being gradually replaced by more sanitary and up-to-date buildings.

The same might be said of the stables, and I trust in a few years that the stables that were put up by the pioneers will gradually give place to more modern and sanitary buildings.

We have only received two complaints from the City Health Officers in regard to the unsanitary production of milk. These places were promptly attended to and have been greatly improved, no further complaints being forthcoming. (For list of the districts and premises visited, with the number of cattle tested and reactors in each district, *see* Appendix No. 15.)

Respectfully submitted.

A. Knight,
Chief Veterinary Inspector.

REPORT OF DISTRICT AGRICULTURIST, KAMLOOPS.

GEO. C. HAY, B.S.A.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—I beg to submit herewith my annual report as District Agriculturist for the year 1918.

THE CANADIAN CO-OPERATIVE WOOL-GROWERS, LIMITED.

To learn the feeling of the sheepmen in the Province of British Columbia with respect to forming a Dominion-wide Co-operative Wool-growers' Association necessitated a personal interview with as many of the sheepmen as possible. Much of your Agriculturist's time was taken up with this work during the early winter, and later in February he was delegate to a convention of Canadian wool-growers held in Toronto for the purpose of discussing the co-operative marketing of Canadian wool. The result of the convention was the formation of the Canadian Co-operative Wool-growers, Limited, which is a joint-stock company, amalgamating the different Provincial associations into a Dominion-wide organization, with head office at Toronto. At this convention your Agriculturist was appointed director of the company for the Province of British Columbia.

Since returning from the East, and more particularly during the spring months when the wool-clip was being marketed, I was busily engaged in the interests of the wool-growers of British Columbia and the Canadian Co-operative Wool-growers, Limited.

INSTITUTE MEETINGS.

During the past year various institute meetings were arranged, and on eighteen different occasions addresses were given on agricultural topics. A series of meetings were held early in June in the Okanagan, Similkameen, and Nicola Districts, and later meetings were held at points along the Cariboo Road to Quesnel. These meetings, generally speaking, were fairly well attended and good interest was shown.

FALL FAIRS.

The fairs visited during the past season were: Knutsford, Vancouver, Quesnel, Duncan, Saanichton, Kelowna, and Surrey. At each of these fairs, with the exception of Vancouver, your Agriculturist judged live stock or field products, or both.

BOYS' AND GIRLS' CLUBS.

A very successful pig-raising competition was carried on with a number of boys in the vicinity of Kamloops. D. W. Strachan, of Tranquille, furnished pigs to the boys, who paid for same at the time of marketing.

A very keen interest was taken by the boys, and the following results will demonstrate their success:—

Name and Address of Boys who received Pigs.	Weight of Pig when received.	Summer Score, July, 30th.	Finished Score, Nov. 7th.	Average Summer and Finished Score.	Weight of Pig, Nov. 7th.
	lb.				lb.
B. E. Connor, Sullivan Valley	28½	92	91	91.5	176
W. Pike, Kamloops	25½*	..	..	..	..
A. Colquhoun, Kamloops	25 †	..	..	..	..
M. Sault, Kamloops	24	93	81	87	142½
B. Church, Kamloops	22 ‡	..	..	..	..
L. Inskip, Kamloops	22 §	..	..	..	..
J. Wight, Knutsford	21	95	96	95.5	182¼
H. Emmerick Kamloops	20	88	82	85	148¼
G. Brown Kamloops	18	88	76	84	135½
A. Sieble, Kamloops	17	94	65	78.5	117

* Sold on account of changing house. † Died. ‡ Accidentally killed. § Accidentally choked to death.

The Provincial boys' and girls' competitions judged were: The boys' and girls' pig-raising competition at Nakusp, Needles, Grand Forks, and Martins Prairie; and the calf-raising competition at Tappen. At each of these places favourable expressions of opinion were heard with respect to the good work of the Department of Agriculture with the boys and girls in the different localities throughout the Province.

SALES.

The holding of periodical agricultural sales in Kamloops was started by the Central Farmers' Institute and conducted by the Markets Committee, of which your Agriculturist is a member. Several more or less successful local sales were held before it was deemed advisable to endeavour to make the sales of Provincial importance. Recently the British Columbia Live Stock Show and Sales Association has been formed, and your Agriculturist has been appointed Secretary. The aim of this association is to encourage the better breeding of live stock in the Province, by holding periodical shows and sales, and by protecting the British Columbia breeders of live stock in every way possible.

OFFICE.

The above lines of work, together with the supervision of the dry-farming stations at Quilchena and the 105-Mile House, and the frequent inquiries for information at the office in Kamloops, has kept your Agriculturist especially busy during the past year. The local farmers and those interested in the work of the Department of Agriculture have been patronizing the Agricultural Office, with an increasing interest in the work; and the furthering of the agricultural interests in this district by the Department of Agriculture is greatly appreciated by all concerned.

QUILCHENA DRY-FARMING STATION.

General.—Another very dry season similar to that of last year has been experienced at the Quilchena Dry Farm. The spring opened fairly early, but was followed by a cold dry spell which retarded growth very much. Later, during the midsummer, a prolonged spell of dry weather occurred, which was so effective that practically all the grain had to be cut for grain-hay. Following the harvest season was a spell of wet weather which started a second growth, and practically all the grain-fields were cut for hay a second time. The hot, dry midsummer very severely burned the ranges, but at all times there was ample feed for the stock.

Live Stock.—A flock of seventy-nine head of grade Shropshire sheep were wintered last winter, which consisted of the following: Fifty mature ewes, twenty ewe lambs, seven wether lambs, and two pure-bred rams. From this flock fifty-four lambs were raised this season. During the summer 151 head were purchased at a cost of $2,207. Later in the fall, from the flock of 284, 142 head of the poorest ewes and butcher animals were sold for $2,304.44. There is now on the farm a flock of 138 ewes and four pure-bred rams, which is valued at $2,831. A detailed statement of the sheep follows herewith:—

Sheep Statement, December 31st, 1918.

	Cost.
79 head on farm December 31st, 1917	$1,049 50
50 head purchased from R. Ferguson	750 00
64 head purchased from 105-Mile Dry Farm	896 00
36 head purchased from 105-Mile House	486 00
1 ram lamb purchased from Western Stock Ranches	75 00
54 lambs from above ewes	540 00
	$3,796 50

Sheep and Wool sold since December 31st, 1917.

	Returns.
46 ewes sold at Kamloops sheep-sale	$ 791 94
76 head sold to H. S. Cleasby (butcher)	1,170 50
4 rams sold to R. L. Clarke	125 00
1 ram sold to J. A. Guichon	25 00
2 ewes sold to Wm. Foster	32 00
1 lamb sold to Clinton Hotel	10 00
12 head sold to H. S. Cleasby (undelivered yet)	150 00
650 lb. wool	390 15
	$2,694 59

Sheep on Farm December 31st, 1918.

	Value.
4 pure-bred rams at $50	$ 200 00
100 ewes at $20	2,000 00
25 ewes at $19	475 00
13 ewes at $12	156 00
	$2,831 00

Horses and other Live Stock.—No horses have been sold during the past year, and in addition to the six that were wintered last winter there are two mare colts raised last summer. The other live stock on the farm consists of a cow and yearling heifer, a couple of spring pigs, and a number of hens.

Field Crops.—Thirty-five acres of land were seeded to different varieties of grain last spring, but unfortunately the weather prevented it from maturing, so it was all cut for grain-hay. About an acre was seeded to kitchen-garden stuff and different roots, and these did remarkably well, as they were in a hollow where they had plenty of moisture. About 10 tons of turnips, carrots, sugar-beets, and potatoes were harvested from less than half an acre. In the spring of 1917 10 acres were seeded to a mixture of timothy, orchard-grass, and red-top seeds. These grasses came along very nicely the first summer, but last season did not grow sufficiently to make it worth while cutting.

During the summer 30 acres were summer-fallowed, and this fall 10 acres were seeded to fall wheat and rye. These crops went into the winter looking exceptionally well. They are well covered with snow and a good crop is expected for next year. Fall grain as a rule does better than spring grain on this farm.

Also during the summer 20 acres of new land were stoned, broken, and put in shape to be cropped next spring. Quite an area of good land might be very easily brought under cultivation on this farm, and it is the intention to break up a little each year.

Potato Experiment.—An interesting experiment with different varieties of potatoes was carried on, and the results obtained follow herewith:—

Potato Experiment conducted at Quilchena Dry Farm, 1918.

Variety.	Measurement of Land occupied by Potatoes.	Date of Planting.	Date of Digging.	Total Weight of Crop.	Per Cent. Marketable Potatoes.	Yield per Acre.	Remarks.
				Lb.	Per Cent.	Tons.	
Early Surprise.	18 hills 2 feet apart	May 15..	Oct. 1st.	65	84.6	13.108	Good size; no scabs; fair crop.
New Queen ...	23 hills 2 feet apart	"	"	98	86.7	15.466	Ditto.
Table Talk....	18 hills 2 feet apart	"	"	95	85.2	19.15	"
Money Maker..	24 hills 2 feet apart	"	"	120	85.8	18.15	Extra good size; no scabs; the best crop.
Drought Proof.	14 hills 2 feet apart	"	"	45	77.7	11.667	Very good, but very few; no scabs; fair crop.
Gold Coin.....	26 hills 2 feet apart	"	"	21	76.1	2.931	Small size; no scabs. Gold Coin potatoes usually grew successfully here. This sample an exception.
Million Dollar.	16 hills 2 feet apart	"	"	52	86.5	11.797	Large size; no scabs; good variety, but few.

105-MILE DRY-FARMING STATION.

General.—The 105-Mile Dry Farm has been under the managership of J. W. McKinley during the past year, and his report, which follows these general remarks, shows the work done on this farm for the year 1918.

This farm also had the experience of another dry season, and in addition had a very severe hail-storm on August 10th, which damaged the grain-crops considerably. Besides, the farm had the misfortune to lose an exceptionally good brood mare at foaling-time, and the majority of the lamb-crop, mainly by coyotes.

A flock of fifty-nine sheep were wintered last winter, which was made up of the following: Forty mature ewes, two yearling wethers, sixteen lambs, and one pure-bred ram. On September

10th this flock was moved from the 105 Station to Quilchena Station, and then numbered sixty-four head. No sheep were sold from the farm, and the increase of five on the above flock was decidedly disappointing.

The results of the grain-crops are included in the manager's report, which follows herewith:—

"Manager's Report of 105-Mile Dry-farming Station.

(Copy from J. W. McKinley's Report.)

"During the past year I cut sufficient wood to last two years. Cut and peeled many fir fence-posts to replace the pine and poplar posts rotted off; quite a number of these have been used. Balance of them are on hand.

"Built two much-needed corrals, one stable, one implement-shed, chicken-house, wood-shed, stock-shed; remodelled old stable by putting in new mangers, stalls, and floor, all made of hewed timber; cut 2,530 pickets and wove them into the woven-wire fence 2 feet apart. This kept the sheep off crops and has greatly improved the appearance of the farm. Built verandah across front of house and made and hung nine substantial gates. Built new stockyard containing 11,025 square feet. No stock reached any of the stacks this season.

"Summer-fallowed 30 acres stubble land; cleared and summer-fallowed 6 acres new land, grubbing small and medium-sized trees and cutting large trees so low that implements pass over them; took off all large rocks and did not require blasting; picked loose rocks before and after ploughing; removed all straggling trees in old fields that were formerly ploughed around; put out manure from barnyard, also old stack-bottoms, for the first time in the history of this farm.

"All the fields are in much better shape for cultivation than ever before; 36 acres ready for crop, 28 acres for summer fallow next season, and about 10 acres seed to grass.

"Fall wheat and rye were medium, barley light, tame hay a failure. All other grains extra good until struck by that awful hail-storm of August 10th. The report on yields is a farce, as it does not represent the amount that grew; oats would have yielded 50 to 55 bushels per acre and spring wheat 20 to 35 bushels. You will note that seed raised on this farm gave best yields. Barley-seed had beards on and could not pass through drill as well as threshed grain would. Therefore there was no chance for a good yield.

"*Grain threshed on 105-Mile Experimental Farm, Season of 1918.*

	Lb.
Fall wheat	720
Fall rye	1,152
Marquis wheat	2,612
Prelude wheat	1,166
Huron wheat	1,462
New Market oats	714
California barley	356
Chiv barley	386
Mensury barley	198

Variety.	Date seeded.	Rate per acre.	Yield per acre.		Date Maturing.
			Bu.	lb.	
Fall wheat	Aug. 18..	6 pecks.	14	0	359
Fall rye	" 18..	5 "	18	16	359
Marquis wheat	April 13..	5 "	14	0	139
Prelude wheat	" 22..	5 "	10	0	133
Huron wheat	" 22..	4 "	9	0	133
Marquis wheat	" 20..	4 "	11	0	133
Huron wheat	" 24..	4 "	7	41	132
Prelude wheat	" 25..	5 "	9	26	131
New Market oats	May 1..	9 "	7	0	127
Marquis wheat (seed from Saskatchewan)	" 4..	80 lb.	6	20	125
Marquis wheat (seed from Kamloops)	" 4..	80 "	5	16	125
California barley	" 8..	64 "	7	20	121
Chiv barley	" 8..	64 "	16	4	121
Mensury barley	" 8..	64 "	8	12	121"

Respectfully submitted.

Geo. C. Hay,
District Agriculturist.

REPORT OF SILO DEMONSTRATOR.

R. J. FERRIS.

W. T. McDonald, Esq.,
Live Stock Commissioner, Department of Agriculture, Victoria, B.C.

SIR,—I beg to submit herewith my annual report for the year 1918.

During the past year the work of this branch was carried in some cases into districts which were difficult to reach through lack of transportation facilities. Two silos were built in the Cariboo country, more than 180 miles north of Ashcroft. The men who built these silos have erected modern dairy-barns, purchased pure-bred dairy stock, and hope to be the means of the farmers in this part of the Province adopting up-to-date methods, so that it will be possible to have a co-operatively owned creamery established at Quesnel.

The Salmon River Valley stretches into the mountains away from the railroad for thirty-eight miles west of Armstrong. A silo was built at Falkland, about half-way up the valley, and the filling demonstration was well attended. Many of the farmers in this district are including a silo in their programme for increased development during 1919. Altogether eleven silos were erected and seven filled during the past season. Silos were built at Gordon Head, Alexandria, near Quesnel, Strawberry Vale, Procter, Hillbank, Ducks, Chemainus, Malakwa, Wilkinson Road, and Albert Head; filling demonstrations being held at Keremeos, Kamloops, Albert Head, Falkland, Procter, Summerland, and Lytton.

There are two districts in British Columbia where the farmers have not yet realized the advantage of using silage to feed their live stock. I refer to the large tract of land which is being developed adjoining the Grand Trunk Pacific Railway, and also the district around the east end of the Kootenay Lake, Creston, and Cranbrook. There is a very large growth of forage in the north, due to a plentiful rain-supply, and when the grains fail to mature, or rain interferes with the haymaking, the silo would take care of the crops. In the southern district they have a warm, dry climate during the growing season and such crops as corn and alfalfa produce heavily. Summer silage could be fed in this district to advantage; in fact, it would be necessary from an economic standpoint to use silage in many cases throughout the year. Educational work is being carried on in these districts, and at present three applications have been received for silos in 1919.

Greater interest is being shown by the farmers in the feeding of silage to beef stock. Silos have been built this year in several places to provide succulent feed for cattle that, as a rule, have been fed principally on dry hay during the winter. Several of the larger stock-ranchers are at present considering the advisability of using silage when wintering their stock. Steers wintered on alfalfa silage in the Vernon District brought a good market price in the early part of last year. Silos would be useful to those ranchers who are directly interested in the development of the Bulkley Valley and Nechako Districts as a stock-raising country.

One of the strong arguments advanced against building a silo is the expense of machinery for filling. In 1917 a silo was built and filled under the supervision of the Department's representative at Willow Point, near Nelson. Last year five more silos were built by farmers in this locality, the largest being 9 x 27 feet. These were all filled with corn by a machine which was co-operatively owned by farmers in this district. Interchange of labour saved cash expenditure for help. These men, who are each keeping a few head of dairy stock as a side-line on their fruit-farms, have proved that by co-operation it is profitable to build a silo 8 x 20 feet.

In 1915 Frank Tarry assisted the Department representative to fill the first silo in the Arrow Lake District, erected at Thrums, near the south end of the Arrow Lakes. This year he purchased a first-class filling outfit and filled fifteen silos in the district. By using a large-sized machine the silos were quickly filled, thereby keeping down the expense. The presence of a large number of silos in this locality is due in a great measure to the missionary work of Mr. Tarry. Many of our farming communities are so placed in the Interior that a community silo-filling outfit would be a good solution to the expensive machinery problem. The machine is only to be used once or twice in the year and by working together an improved co-operative spirit should grow among the farmers.

There has been a large increase during the last year in the number of silos in the Province. The system which has been followed during the last four seasons by the Live Stock Branch of the Department of Agriculture, of assisting in the building and filling of silos in new districts,

has introduced them into the majority of our farming communities. Up to the present ten silos have been built and eleven filling demonstrations held in farming districts near the main line of the Canadian Pacific Railway. From Enderby south to Penticton, including the Okanagan, nine silos have been erected and the filling demonstrations have been well attended. From Revelstoke south six have been built in the Arrow Lakes District, and other farmers have built and are contemplating building silos this year. Three have been placed at different points in the Columbia Valley and six in the Fraser Valley. Many of the other valleys on the Mainland have been visited and a silo has been built and filled in order to leave a practical lesson of the benefits to be obtained by feeding silage. Fifteen silos have been erected on Vancouver and adjacent islands and a large number of filling demonstrations held. We have up to the present time built sixty-three silos and also held fifty-one filling demonstrations. Ontario is the only Province in Canada that has more silos *per capita* than British Columbia. By maintaining the present rate of progress this honour will be annexed by this Province in the near future.

Those farmers who have had their silo or silos to assist them through the winter of 1918-19 have been able to meet the extraordinary demands which have been made upon their finances when purchasing other live-stock feeds, especially for dairy herds.

A circular bulletin entitled "Silage aids Production" was published during the year. This contains a lot of information with reference to silos and silage which has been gathered during the time the Department of Agriculture has been endeavouring to increase the popularity of the silo in British Columbia. More than 2,000 copies have been distributed.

Besides circular letters, more than 300 letters have been received and 400 dispatched.

All of which is respectfully submitted.

R. J. Ferris,
Silo Demonstrator.

REPORT OF PUBLICATIONS BRANCH.

R. J. Ferris.

W. T. McDonald, Esq.,
Live Stock Commissioner, Department of Agriculture, Victoria, B.C.

Sir,—I beg to submit herewith the following annual report for 1918:—

On the departure of M. A. Stuart from the position of Editor and Chief of Publications Branch on April 30th, 1918, at your request I took charge of this division of the work of the Department of Agriculture.

The *Agricultural Journal* has been in circulation nearly three years and is becoming a familiar publication to the farmers in the various rural communities in British Columbia. Copies are also forwarded to Colleges of Agriculture, Provincial Departments of Agriculture, and the State Libraries in Canada and the United States. In addition to numerous individual subscribers in British Columbia, there are a number of subscribers from the Prairie and Eastern Provinces. By the use of its pages the officials of the Agricultural staff have been able to place educational material on thousands of farms each month. Considering the huge size of this Province, and how the farming community is scattered along the banks of rivers, lakes, and in the many valleys among the mountains, without the use of this *Journal* only a small percentage of the farming community could be approached by the officials at stated times. During the past year the circulation of this publication has increased from 2,500 to 6,000 monthly.

The staff of the Department has supplied the majority of the educational articles which have been used in this publication. We are also indebted to members of the staff of the Dominion Department of Agriculture located in British Columbia, from whom many instructive articles dealing with agricultural development have been received. Numbers of the farmers have forwarded material to be used in the *Journal*. They have placed at our disposal a lot of intelligent information which has been of great assistance to our many readers. The public-spirited action of these men in spending their time in endeavouring to improve agricultural conditions is a cause for satisfaction. We hope to be able to enlist their further co-operation. Increased interest is

manifested by the articles which are being received from members of the Women's Institutes; these are coming principally from the Interior points. They deal as a rule with problems which are facing the rural communities and also the Province. Often after giving a clear statement of conditions in their own section, or as they affect the Province, remedies are suggested which are well worth consideration. There is an earnest desire evidenced in their correspondence to do some real work. One lady, when sending an article, stated: "If you think this article will do any good, use it, for my heart is in the work."

A keen interest in this publication is being taken by the members of the Farmers' Institutes. It is hoped that by an intelligent use of the *Journal* it may be the means of drawing the institutes into closer co-operation with one another. This organization, with its 152 societies and a membership of more than 6,000, wants to find in the *Journal* a means of keeping in touch with the business condition of the farmers in British Columbia. At the present time the institutes are reorganizing along more efficient lines. With the influx of numerous soldier-farmers who are returning from the battle-fields of Europe, the institutes hope to be the leading factor in the advancement of rural conditions in our Province. Special attention will be given during the coming year to reports which are forwarded to the Department of Agriculture by the Secretaries of the Farmers' Institutes. These will be carefully read and whenever possible extracts will be published in the *Journal*. There are many ways by which a journal devoted to the farming interests alone can further schemes for the improvement of agriculture in British Columbia.

There have been numerous requests from different Colleges of Agriculture, libraries, and individual subscribers for printed indexes to Volumes I. and II. These have been prepared and are being forwarded to those who need them, upon request.

A new list of the various publications which are issued by the Department of Agriculture was arranged and published in the early part of the year.

At the request of Captain Oliver, who represented the Khaki University, London, a large supply of bulletins and circulars were forwarded to Europe, to assist in the education of the soldiers in agriculture. They were to be used by the many branches which have been established by the University in England, France, Belgium, and within the borders of Germany. Nearly 3 tons of literature were dispatched. It was also arranged that, if circumstances did not allow for the using of all this material for that purpose, the balance was to be forwarded to the Agent-General for British Columbia at his London office.

There have been numerous requests for bulletins; these have been forwarded. Four hundred and seventy-five letters have been received and 375 mailed.

All of which is respectfully submitted.

R. J. FERRIS,
Acting-Editor and Chief of Publications.

REPORT OF SECRETARY FOR THE DEPARTMENT OF AGRICULTURE.

WM. J. BONAVIA.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—I have the honour to submit herewith my report on the general work of the Department for the year ending December 31st, 1918.

STAFF.

The Estimates for the fiscal year ending March 31st, 1919, provided for forty-eight permanent officials of all ranks, being an increase of four over those for the preceding year. The year has again been marked by a large number of resignations. On the death of the Hon. H. C. Brewster, Premier of this Province, the Hon. John Oliver resigned his position as Minister of Agriculture and was succeeded by the Hon. E. D. Barrow on April 25th. Wm. E. Scott, Deputy Minister and Superintendent of Institutes for many years, was also obliged to resign his appointment owing to ill-health on August 31st.

Resignations.

Date.	Name.	Rank.	Remarks.
Jan. 31	G. S. Rothwell	Clerk	Overseas service.
April 30	M. A. Stewart	Editor (Publications Branch)	Farming.
" 30	G. B. Martin	Clerk	Superannuated.
May 31	J. H. Buckett	Junior Clerk	Overseas service.
June 30	P. E. French	Assistant Horticulturist (Vernon)	Farming.
" 30	Miss M. M. Patchett	Stenographer	
" 30	A. LeWarne	Cow-tester	
July 31	E. Brookland	Foreman (Dry Farm, Quilchena)	Farming.
Aug. 15	E. J. Rossiter	Private Secretary (Minister of Agriculture)	
" 31	Mrs. E. Williams	Stenographer	
" 31	Wm. E. Scott	Deputy Minister	Superannuated.
Oct. 31	H. O. English	Soil and Crop Division	Farming.
Nov. 30	M. S. Middleton	Provincial Horticulturist	"
" 30	Miss. A. V. Evans	Stenographer	

Appointments.—The following staff appointments were also sanctioned during the year, the majority of them being replacements of officials who had resigned, etc., with the exception of Mrs. V. S. MacLachlan, who was appointed Secretary of the Advisory Board of Women's Institutes:—

Date.	Name.	Rank.
Jan. 1	Mrs. V. S. MacLachlan	Secretary Advertising Board of Women's Institutes.
" 7	W. T. Andrews	Accountant.
" 22	Miss A. V. Evans	Stenographer.
Feb. 22	Miss G. Burnyeat	"
March 7	Mrs. C. J. Clark	"
April 1	Miss G. H. Hawes	" Vancouver.
" 1	Miss N. Evans	"
May 1	A. LeWarne	Cow-tester.
July 1	J. A. Munn	"
" 3	A. J. Hourston	Clerk.
Aug. 15	F. W. Laing	Private Secretary, Minister of Agriculture.
" 29	Miss. M. V. Hamelin	Stenographer.

Officials Overseas.—Occasional reports from departmental officials overseas indicate that, whilst actively employed, no serious casualties have occurred. A report at the end of December, however, was received with regard to W. H. Robertson, Assistant Horticulturist, to the effect that he had been severely injured by a shell and that he was slowly recovering in hospital.

Temporary Appointments.—A total of seventy-five temporary appointments were made during the year, as against 109 in 1917; twenty-one of these being carried by the "Agricultural Instruction Act," as per attached statement.

Provincial Estimates—

Inspector, Brands	1	
Inspectors, Imported Fruit	17	
" Nursery Stock at Vancouver	5	
" District Field	8	
Judges, Fall Fair Associations	18	
Stenographers	3	
		— 52
Soldiers of the Soil, Stenographers	2	
		— 2

"Agricultural Instruction Act"—

Assistant Horticulturist	1	
Caretaker, Demonstration Plots	1	
" Egg-laying Contest	1	
Clerical	1	
Carried forward	4	

Brought forward	4
"Agricultural Instruction Act"—*Concluded.*	
Cow-testers	4
District Agriculturist	1
Field Officer, Assistant Entomological Branch	1
Foremen at Dry Farm	2
Inspector, District Field	1
Inspectors, Foul-brood	3
Plant Pathologist (Assistant)	1
Publications Branch, Editor and Silo Demonstrator	1
Soil and Crop Instructor	1
Stenographers	2
	— 21
Grand total	75

CORRESPONDENCE.

A total of 8,390 letters were received in the Deputy Minister's office and 9,207 sent out during the year, as against 8,404 and 11,345 the previous year. The attached table shows the total correspondence for the Department at Victoria.

Appendix No. 18 shows full details of the correspondence for the Department at Victoria.

Circular Letters.—The total number of circular letters sent out was 21,010, grouped as follows:—

Agricultural Associations	395
Dairy Division	2,685
Fruit-growers	100
Farmers' Institutes	5,050
Goat-breeders' Association	340
Horticultural Branch	1,060
Miscellaneous letters	1,295
Poultry Branch	1,545
Publications Branch	415
Soil and Crop Division	2,680
Stock-breeders' Association	360
Statistics Branch	2,385
Women's Institutes	2,700
Total	21,010

PUBLICATIONS.

The number of new publications issued during the year has been less than usual, owing partly to the fact that the *Agricultural Journal*, issued monthly, contains a number of articles by experts in the Department that would have, in the past, been issued as circular bulletins or departmental circulars. A total of 71,000 copies of the *Agricultural Journal* were issued during the year, giving an average monthly circulation of 5,916 copies. Special large editions comprising 6,500 copies were published in April and August. The other new publications were as follows:—

Date.	Name.	Description.	No.
1918.			
Jan. 11	Circular No. 19	Honey Production in B.C.	2,000
Feb. 5	Report of Department of Agriculture	For year 1917	1,500
March 4	Circular	*Re* Boy-labour, S.O.S	2,000
" 13	Circular Bulletin No. 22	Medical Inspection of Schools	2,000
" 18	Circulars	*Re* Seed-grain Distribution	1,000
May 2	Bulletin No. 30 (Second Edition)	Guide to Bee-keeping	3,000
" 28	Leaflets	To School Principals *re* Production	700
July 5	"	*Re* Farmers' Labour Bureau	6,000
" 29	Bulletin No. 80	Market Rabbits	5,000

Horticultural Circulars issued in 1918.

No.	Name.	No. issued.
6	Spray Calanders	3,000
31	Peach-twig Borer	2,000
32	The Cabbage-root Maggot	10,000
33	The Strawberry-root Weevil	4,000
34	The Woolley Aphid of the Apple	5,000
35	Currant Gall-mite	1,000
36	The Onion-thrips	2,000
37	The Imported Cabbage-worm	5,000
38	Codling-moth	3,000
39	Apple-aphides	5,000
40	Soap Solution for Spraying	5,000
41	The Oyster-shell Scale	5,000
42	Top-working of Fruit-trees and Propagation	10,000
43	Gardening on a City Lot	10,000
44	Apple-scab	10,000
45	Anthracnose	5,000
46	Egg-plant and Pepper Growing	5,000
47	Cucumber and Cantaloupe Growing in B.C.	5,000
48	Forcing Houses and Frames	10,000
49	Tomato-growing in B.C. Dry Belt	5,000
50	Potato-diseases	10,000
51	Orchard Cover-crops	.....
52	Diseases of Stone-fruits in B.C.	5,000

Bulletins and Circulars dispatched during the Year.—A total of approximately 50,000 bulletins, circular bulletins, and departmental circulars were mailed during the year, being a slight increase on the numbers mailed in 1917. The reissue of the circulars by the Horticultural Branch under the joint supervision of M. S. Middleton, R. C. Treherne, E. W. White, and J. L. Hilborne proved their popularity.

In addition to the above issue, seven large packing-cases weighing almost 3 tons, being a selection of all departmental publications, were sent by special request to the Khaki University, England, to be used as text-books by instructors in connection with soldiers who were taking agricultural courses prior to returning from overseas.

Financial.

The financial appropriation amounted to $219,684, as against $208,002 for the previous year. Special warrants were also obtained during the year for $4,500 in connection with the Coast Markets Commissioner's Office, and other special warrants, as follows:—

Coast Markets Commissioner's Office	$ 4,500 00	
Travelling expenses, Hon. E. D. Barrow	1,000 00	
Compensation for bee-keepers	386 10	
Office supplies	1,750 00	
Travelling expenses, Horticultural and Live Stock Branch	5,250 00	
Agricultural Associations	1,000 00	
Departmental exhibits	750 00	
Compensation for codling-moth destruction	1,500 00	
Grand total for fiscal year		$16,136 10
Supplementary votes—		
Frondeg Farm expenditures	$ 4,000 00	
Purchase of fish fertilizer	3,500 00	
		7,500 00
		$23,636 10

(*See* Appendix No. 19.)

The gross receipts of the Department of Agriculture amounted to the sum of $113,549.36, of which the sum of $53,171.34 was revenue. Of this sum, $21,981.14 was horticultural inspection

fees and licences, the balance being composed of seed-grain refunds, brand registry fees, and miscellaneous.

"*Agricultural Instruction Act, 1918-19.*"—The following payments were received during the year from Ottawa:—

April 6th, second half of grant, 1917-18	$29,349 53
May 1st	1,343 33
August 22nd, advance on account first half of 1918-19 grant	10,000 00
December 11th, " " " "	5,000 00
December 30th, balance of first half of 1918-19 grant	19,599 53
Total	$65,292 39

The number of cheques drawn on the special account of the Department in the Canadian Bank of Commerce during the year was 2,029. The total expenditures under the various sections of the "Agricultural Instruction Act" were as follows:—

March quarter	$13,850 05
June quarter	28,805 00
September quarter	12,935 75
December quarter	12,958 82
Total	$68,549 62

The bank balance on December 31st being $15,233.39.

There has been a very notable increase in the number of vouchers issued both for Provincial and Federal payments. This has been due partly to the more detailed system of accounting required by the Comptroller-General.

"*Seed-grain Act, 1918.*"—This Act, being chapter 75 of the Statutes of 1918, provided a sum not exceeding $50,000 to be advanced to the Minister of Agriculture during the year for the purchase and distribution of seed-grain as might be required and necessary to enable occupiers and owners of land to seed their land. This Act was in accordance with the Dominion-wide campaign to increase food production owing to the shortage of food-supplies throughout the world.

The following amounts were received as seed-grain refunds during the year:—

1915, distribution	$ 262 62
1917, "	4,707 82
1918, "	8,456 92

At the close of the year payments for the 1918 distribution were coming in fairly well, but a large sum is still outstanding on the 1915 distribution.

Increased Food Production, 1918.—The Dominion Department of Agriculture, as a further war measure to increase food production throughout Canada, allotted grants to each Province to be spent for the above purpose on condition that the Provinces themselves put up a similar amount. The grant for British Columbia amounted to $15,000, of which $7,500 was paid during the year. The grant has been used chiefly in carrying expenses in connection with the Soldiers of the Soil movement.

BRITISH COLUMBIA STUDENTS.

Owing to the war very few British Columbia students were enrolled at any of the Agricultural Colleges during the year. The following were the students to whom grants were paid:—

Miss F. L. Fullerton, Home Economics Course, University of Toronto.
Miss F. E. McEwen, Home Economics Course, University of Toronto.
E. C. Hassel, Agricultural Course, Ontario Agricultural College, Guelph, Ont.
Miss G. Hallwright, Home Economics Course, Ontario Agricultural College, Guelph, Ont.

BEE-INSPECTION WORK.

F. D. Todd, of Victoria; L. Harris, of Vernon; and W. J. Shepherd, of Nelson, were again appointed Inspectors under the "Foul Brood Bees Act" for the Lower Mainland, Okanagan, and Kootenay Districts respectively. The production of honey during the year was a record one; the Inspectors estimate that over 200 tons had been produced during the season, whilst the total number of bee-keepers recorded by the Department had risen to 1,611. In the Cloverdale District, near Vancouver, there was a serious epidemic of European foul-brood which required the attention of two Inspectors. The Okanagan and Kootenay Districts were practically exempt from this

disease. Expenses of administering the Act were carried on a section of the "Agricultural Instruction Act" and totalled $3,365.32, and as the total grant for the year was only $2,500 the next year's operations will have to be financed to a certain extent by the Province. A total of $386.10 was paid in compensation to bee-keepers whose hives had been destroyed on account of this disease.

FARMERS' INSTITUTES.

A total of 154 Farmers' Institutes were recorded at the close of the year, being an increase of seven since the close of 1917. The new incorporations were:—

(1.) Mount Ida ..... February 19th, 1918.
(2.) South Bulkley ..... April 23rd, "
(3.) North Fraser ..... " "
(4.) Lardeau-Duncan ..... June 20th, "
(5.) Big Eddy ..... July 11th, "
(6.) Forest Grove ..... October 28th, "
(7.) Creston ..... November 29th, "

Owing to the continued absence of many members overseas a large number of institutes were reported as temporarily closed down, the total number being twenty-two. The total membership recorded for the year was 6,072, as against 6,194 at the close of 1917. The institutes with the largest membership were as follows:—

Spallumcheen	198
Creston	177
Cowichan	145
Delta	136
Kelowna	110
Islands	101
Martin's Prairie	100
Chilliwack	85
Comox	85
Metchosin	85
Victoria	85

Advisory Board.—During the year a scheme outlined by the late Deputy Minister for grouping institutes into nine districts was brought to a successful conclusion, as follows:—

District.	Area.	Member.
A.	Vancouver Island and Gulf Islands	C. E. Whitney Griffiths, Metchosin.
B.	Bella Coola, Bnlkley Valley, Skeena and Nass Valleys	H. Silverthorne, Telkwa.
C.	Prince George, including district from Endako to McBride	J. S. Ross, Fort Fraser.
D.	Kamloops, North Thompson Valley, Nicola Valley, and district between St. Elmo and Revelstoke	Wm. Harrison, Martin's Prairie.
E.	Langley and all institutes on south and north sides of Fraser to Chilliwack and Howe Sound	Jas. Bailey, Chilliwack.
F.	Grand Forks, Arrow and Slocan Lakes and Boundary Districts	C. C. Heaven, Grand Forks.
G.	Kelowna, including Okanagan Valley from Mara to Kaleden, also Salmon River Valley	L. E. Taylor, Kelowna.
H.	Robson, Kootenay Lake, and Kootenay River Institutes	R. Staples, Creston.
I.	Cranbrook, South-east Kootenay, and Columbia Valley	A. B. Smith, Cranbrook.

A meeting of the Advisory Board was called in November and held at Victoria, when a large number of resolutions were dealt with and submitted for the consideration of the Hon. the Minister. A notable feature of the year has been the increased co-operative work carried on by institutes. The annual reports received indicate great activity in all parts of the Province; large purchases of feed and flour and other supplies in car-load lots for members have been successfully undertaken, and at the time of making up this report there is evidence that the movement is branching out into wider schemes, to include the organization of district co-operative societies to undertake buying and selling under the authority of the "Agricultural Act, 1915," and amendments.

The total expenditure of Farmers' Institutes for the calendar year amounted to $9,308.10, or an average of $60.83 per institute. (For full details *see* Appendix No. 20.)

A large proportion of institutes have now raised their fee to $1 per annum in order to obtain the similar grant allowed by the Department.

Gopher-poison amounting to the sum of $454.56 was purchased and distributed at cost price to the institutes in the Kootenays and other districts where this pest is a serious one.

The total amount of stumping-powder supplied to Farmers' Institutes during the year was valued at $23,340.25. During the year the cost per case reached the record figure of $10.25, but owing to the release of raw material hitherto required by munition-factories the price showed a tendency to drop round Christmas, and considerable reduction is anticipated by the spring of next year.

Short Courses and Lectures.—Owing to the depleted staff of the Department no arrangements for this work were made.

Fairs held by Farmer's Institutes.—The following fairs were organized by institutes during the year: Terrace, September 16th; Denman Island, September 21st; Rock Creek, October 11th; Peace River, September. Judges were supplied by the Department in the cases of Denman Island, Terrace, and Rock Creek, who reported exhibits of agricultural produce to be of a high order.

WOMEN'S INSTITUTES.

During 1918 two new institutes were organized, as follows: South Saanich, February 11th; Salmon River Valley, July 11th; making a total incorporated of sixty-two; the total membership for the year being 2,428, as against 2,754 in 1917. The ten institutes with the largest membership during the year were as follows:—

Cowichan	125
Cranbrook	123
Penticton	119
Kelowna	89
Kaslo	82
Vernon	74
Tillicum	72
Shawnigan	71
Creston	66
Nelson	63

The total expenditure on Women's Institutes for the calendar year was $4,826.75, or an average of $77.85 per institute; this being a very considerable decrease on the cost of administering these institutes in the previous year, when the total amount expended was $8,742.03. (*See* Appendix No. 21 for full details.)

Conferences.—Conferences were held as follows during the year: Kelowna, October 8th to 10th; Kaslo, October 15th and 16th. Owing to the Spanish influenza epidemic the conferences for the Lower Mainland and Vancouver Island institutes were postponed until the next year. A number of interesting resolutions dealing with the "welfare of women and children" were submitted and carried. A new feature of the conferences was the election of members for the Advisory Board in accordance with the provisions of the "Agricultural Act" and amendments; Mrs. J. S. Chalmers, of Thrums, replacing Mrs. Jas. Johnstone, of Nelson, as member for the Kootenay District, and Mrs. A. L. Trask, of Oyama, being re-elected for the Kootenay and Boundary District.

Lectures and Demonstrations.—Owing to the continued activity of institutes along Red Cross and patriotic lines the Department did not arrange for any lectures during the year. Owing, however, to numerous requests having been received in the Department in the fall of the year it is recognized that this work must be taken up again in a systematic manner.

Flower-shows.—Thirty-one institutes held flower-shows during the year, as against forty-one in 1917. The Department supplied the usual book prizes and the grant of 25 cents *per capita*. Reports show that these events were conducted in a very satisfactory manner, both from a social and financial side. At many points these flower-shows have broadened out so as to include exhibitions of women's work and increased food production.

Competitions, Year 1917.—Owing to the difficulty of obtaining judges these competitions were not finally decided until late in 1918. The winners were as follows:—

(*a.*) Best Average Attendance at Meetings based on June Membership.—First, Hazelmere, 91 per cent.; second, Gordon Head, 88 per cent. Next in order of merit: Atchelitz, 86 per cent.; Langford, 82 per cent.; Colwood, 75 per cent.; Crawford Bay, 70 per cent.

(*b.*) Programme Competition.—The programmes were judged by Mrs. J. D. Gordon and Mrs. Graves, of Victoria, who expressed extreme interest at the many admirable programmes submitted for this competition. The awards were given as follows: First prize, Salmon River Valley, now Silver Creek Women's Institute. The decision was made on the originality and excellent appearance of the programme, combined with general neatness. Choice of subjects was also carefully made, and the programmes, being hand-made, were especially commended for economy in production and for attractive appearance. Second prize, Metchosin Women's Institute. The subject-matter was excellent and the general artistic appearance in the hand-painted programmes caused favourable comment. Third prize, Tappen Women's Institute. The subject-matter of this institute was exceedingly well got up, and although the paper and type was of a less expensive nature than certain other competing programmes, the judges had no hesitation in giving this third place.

(*c.*) Essay Competition.—First prize, "Meaning of Democracy," Mrs. O. H. Carle, Similkameen Women's Institute; second prize, "Some of our Problems when Peace Comes," Mrs. Sidney File, Nakusp Women's Institute, Nakusp; third prize, "Domestic Science and Household Economics," Mrs. J. R. Tweedale, Salmon River Valley Women's Institute, Salmon Arm; fourth prize, "Maintaining the Health and Happiness of the Household," Mrs. E. N. Applewhaite, Willow Point Women's Institute, R.R. No. 1, Nelson.

(*d.*) Competition for Junior Members.—No prizes awarded.

Horticultural Bonds and Licences.

During the year a total of twenty-eight licences were issued, as against thirty-nine in 1917. These were made up as follows: Principals, foreign and British Columbia nurserymen, 12; agents for foreign and British Columbia nurserymen, 16. The continued drop in the issue of these licences is noticeable, the business being largely concentrated in the hands of two or three firms.

During the year an important amendment to the "Agricultural Act" of 1915 affecting nurserymen was passed. Section 7 of the Amendment Act provides that a bond might be dispensed with upon any nurseryman obtaining a certificate of inspection showing that his nursery was free from all insect pests and contagious diseases injurious to fruit-trees, plants, or nursery stock. Whilst considerable correspondence has ensued, no licences have been issued by the Department under this amendment during the year, but it is anticipated that the concession will be taken advantage of next year to a considerable extent.

Agricultural Fairs.

During the past season forty-one agricultural fairs were arranged for by the Department, judges being supplied to all points as in previous years. Of the above number of fairs, five were organized by Farmers' Institutes where there were no incorporated Fair Associations.

Speaking generally, these fairs have been unusually successful, exhibits being of a higher class than usual, and owing to the warm, dry season all horticultural products were well developed and of a high colour; the educational work carried out by the Department also during the past few years was evidenced in the arrangement and better selection of entries.

Both at Duncan and Saanichton, on Vancouver Island, the fiftieth anniversary of the local association was celebrated, and a splendid display of agricultural products of all kinds gave striking testimony to the strength and popularity of these associations. Owing to reasons of economy judging was almost entirely undertaken by the officials of this Department, with the exception of the following experts, whose services were requisitioned for live stock:—

Dr. S. F. Tolmie, M.P.	Light horses.
Geo. Shannon, Cloverdale	Heavy horses.
Prof. L. Stevenson, Saanichton	Dairy cattle.
P. Moore, Colony Farm	„
Sam Shannon	„

S. H. Hopkins, Duncan	Dairy cattle.
John A. Turner, Victoria	Beef cattle and sheep.
Bryce Wright, Victoria	All classes of stock.
H. W. Hicks, Experimental Farm, Agassiz	Sheep.
W. McIntyre, Chilliwack	Horses.
E. H. Barton, Chilliwack	Pigs.
Joe Bulman, Grande Prairie	Sheep.
H. E. Waby, Enderby	Dairy cattle and poultry.
A. B. Smith, Cranbrook	„ „
F. Fleetham, Revelstoke	„ „
Prof. H. Barton	Dairy cattle.
Dr. H. D. Parker, Wash.	Goats.
H. D. Reid, Victoria	Poultry.
E. A. Orr, Chilliwack	„
W. Walker, Chilliwack	„
W. N. Scott, Trail	„
W. J. McKim, Nelson	Horticultural products.
S. LeC. Grant, Bella Coola	„ „
J. B. Partington, Victoria	„ „

Grants.—A total sum of $10,850 was paid by the Department in grants in aid of prize-lists to those associations holding fairs, the amount being $2,000 less than the total for 1917. (*See* Appendix No. 22 for full details.)

GENERAL.

For financial reasons no convention was held during the year, the arrangements for dates, judges, etc., being by correspondence with the Department. This system, although having the advantage of economy, makes the final arrangements long drawn out, and in many cases it has been difficult to prevent overlapping of dates; whereas, on the other hand, minor differences could easily be adjusted by delegates talking matters over at a central meeting. Owing to the continued decision of the directors of the Royal and Industrial Association at New Westminster not to hold a fair, the position of the Vancouver Exhibition Association has been materially strengthened during the war period, and the 1918 fair was undoubtedly one of the most successful this association has ever held, both from the number and quality of exhibits, as well as from the point of attendance, general management, and financial results. Live-stock features of the exhibition were very prominent, a total of 281 head being shown; breeders from Vancouver Island and other Interior districts sending entries.

All of which is respectfully submitted.

WM. J. BONAVIA,
Secretary.

REPORT OF STATISTICS BRANCH.

A. B. TWEDDLE.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—I beg to submit herewith the annual report of the Statistics Branch for the year 1918.

SCOPE.

The duties of this Branch during the year consisted of the collection of data relating to agricultural production, imports, exports, and cost of production.

In 1917, in co-operation with the Dominion Bureau of Statistics, figures relating to crop areas and numbers of live stock were collected conjointly by means of a postal census; card schedules being distributed to all farmers whose names appeared as such on the latest Provincial voters' lists. The results were considered so satisfactory that the same plan was continued in 1918.

Data relating to imports from other Provinces in Canada are now being collected by means of returns from as large a number as possible of the chief distributers of agricultural food products in the Province.

With this method results depend entirely upon the goodwill of such establishments, there being no inquisitory power existing within this Province. Various appeals have been made to the transportation companies for such data, but these have so far been unsuccessful.

Data showing "foreign imports" are obtained from the Dominion Department of Customs, and include quantities and values for the calendar year.

1918 Postal Census.

The total number of card schedules dispatched from this office was 21,400, and the total number of returns received and compiled 6,534, or 42.5 per cent. of the estimated number of farmers in the Province—viz., 15,360.

In determining totals, 57.5 per cent. of the total number of farmers was added to the results of the returns compiled in the case of crop areas, sheep, swine, and poultry. Results regarding the number of horses and cattle indicated that there had been gross concealment of facts, since these showed a falling-off of 62 per cent. in horses and 32 per cent. in cattle, which was plainly untrue. These results were therefore discarded and results from the crop correspondents accepted instead, totals being based upon those of 1917.

The percentage of total returns in 1918 was 3.5 per cent. less than in 1917, notwithstanding a more thorough campaign toward increased results. This may well be attributed in part to the shortage of farm-labour, resulting in operators being extremely busy during the month of June, when the census was taken. Increased fear of further taxation may have also contributed to this cause.

Crop Correspondents.

The voluntary services of ninety-six crop correspondents in the various sections of the Province were enlisted by this office in April, 1918, who were asked to report to the Statistics Branch, Victoria, on crop conditions each month except November. Of the total enlisted fifty-nine reported during three or more months from May to October, inclusive (December reports still outstanding).

In addition to these correspondents, ninety-three were appointed by, and asked to report to, the Dominion Bureau of Statistics, Ottawa. By mutual agreement the two offices exchanged results and agreed upon an average for publication. By this arrangement the result in former years of conflicting figures by the two officers was eliminated.

City and Suburban Food Production.

At the request of the Canada Food Board for data relating to city and suburban food production in this Province during 1918, a postal census was taken under the joint supervision of J. W. Gibson, Director of Agricultural Education, and this office. Card schedules were distributed to all small-lot producers possible, in both city and suburban districts of the Province, through the medium of the public schools.

The total number of cards distributed was 31,393, and the total returns received and compiled by this office was 9,770, or 31.1 per cent.

Cost of Production.

This work, which in 1917 was conducted by the Soil and Crop Division in so far as it related to certain field crops only, was at the beginning of the current year undertaken by your Statistician in order that all crops and branches of farming might be included to better advantage. Accordingly the necessary forms were prepared, and whilst the aim was to secure 400 farmers who would undertake the work, only eighty-three finally consented to do so. The actual recording began on March 1st, 1918, to be continued for one year, so that results cannot be submitted at the time of this report.

During this particularly busy time it is difficult to get farmers to undertake this work. Such work possesses invaluable possibilities in educating farmers toward better business principles and management, and no effort will be spared to make it as universal as possible.

Publications.

Owing to pressure of work the data for the 1917 Statistics Bulletin could not be prepared until too late to make it economically wise to print. The 1918 bulletin will, however, be prepared early in 1919 and will include the 1918 data.

The results of the monthly crop returns from correspondents were published each month in the Department *Agricultural Journal*. One circular, "Instructions for keeping Records relating to Cost of producing Farm Products" (No. 20), was issued and published.

OFFICE.

Attention to the details in connection with the rural and city and suburban censuses, as already outlined, and the compilation of results of these and monthly crop returns occupied almost the entire time of your Statistician and that of an assistant for a period of six months.

Respectfully submitted.

A. B. TWEDDLE,
Statistician.

REPORT OF APIARY INSPECTION AND INSTRUCTION, KOOTENAYS AND BOUNDARY.

W. J. SHEPPARD.

Hon. E. D. Barrow,
Minister of Agriculture, Victoria, B.C.

SIR,—I beg to submit my annual report on the above work for the year 1918.

The season just passed has not been quite so good for honey production as last in this territory owing to dry spells that somewhat curtailed the blossoming period of the clovers and other nectar-yielding plants. The honey has all been of good quality, as is usual, and apparently there has not been any honey-dew or fruit-juice stored by the bees this fall, so that winter losses should be few, and, in any case, will not be attributable to this cause, as in some past years.

Bee-keeping is going ahead in this section of the Province, two large apiaries having been installed during the past season in one of the best locations by progressive bee-keepers, who will no doubt make a success of them.

Honey is in increasing demand in the Kootenays and not nearly enough is yet produced locally to keep the home market supplied. The wholesale price at present stands at 35 cents per pound for extracted honey, and at this figure this industry is a good paying investment on the small amount of capital required. There has been a great demand for bees here, and several persons desiring to start bee-keeping have been unable to do so through being unable to obtain them. Bees have been practically unobtainable in pound packages this year from the United States, owing, it is stated, to the transportation companies declining to undertake to deliver them by the shortest and quickest routes. By a new postal order in the United States bees in pound packages can now be shipped through the mails, and if this was extended to Canada this difficulty would be overcome and the present shortage of bees supplied.

A demonstration on bee-keeping was given to the members of the Women's Institute at Harrop on May 8th. Educational exhibits of honey, etc., produced in the Kootenays were made at the Nelson Rose Show held during the Western Irrigation Congress on July 24th, at the Trail Fruit Fair on September 17th and 18th, and at the Nelson Fruit Fair on September 25th and 26th. Great interest has been taken in these exhibits and applications have been received for them at other places.

Experiments have been carried out during the season at the writer's apiary in Nelson with different queen-excluders in connection with swarm-control, the production of sections, etc., and valuable data obtained.

There is very little disease in the Kootenays, only six cases of American foul-brood having been found in three apiaries during the past season. One colony was destroyed and the others have been treated by shaking.

Your Inspector was summoned to Vancouver about the middle of June to assist with inspection-work owing to the serious outbreak of European foul-brood on the Lower Mainland, and was engaged thereon for about a month in the Cloverdale District. A separate report on this work was made and sent in at the time. Owing to this absence some of the bee-keepers in outlying districts in the Kootenays have not been visited this season.

Respectfully submitted.

W. J. SHEPPARD,
Foul-brood Inspector.

REPORT OF SOLDIERS OF THE SOIL MOVEMENT.

Jas. H. Beatty.

W. T. McDonald, Esq.,
Acting Deputy Minister and Live Stock Commissioner,
Department of Agriculture, Victoria, B.C.

Sir,—I beg to submit herewith the report of the Soldiers of the Soil Movement for the year 1918.

Enlistments.

The movement encouraged the enlistment of all boys between the ages of fifteen and nineteen years of age, and recognized, but not accepting any responsibility for, boys between the ages of thirteen and fifteen. Boys who came within the above ages and whose school principal recommended them for passing were, upon having completed two months' satisfactory service as Soldiers of the Soil, given their promotion in school without further examination.

Eighteen hundred boys enlisted and sent in their forms. This number includes boys who were working but who had not previously enlisted. These were later registered and were given the same consideration as others who had enlisted previous to being employed.

Placements.

The boys working on farms totalled 1,137. A number of these were, of course, working on their parents' farms, but they received the same consideration from the "S.O.S." movement as did boys who were working on strangers' farms. The farmers' applications came in very slowly at first, and a number of the boys had secured other employment before they were called up. Before the season ended, however, it was difficult to get boys to supply the demand of the farmers.

Over a hundred British Columbia boys were sent to the Prairie to do farm-work. The railway companies gave a reduced rate going, but charged them full fare on their return. It would be difficult to encourage boys from this Province to go to the Prairie without giving some special transportation rate both ways.

Wages.

The wages for boys ranged all the way from $5 to $75 monthly and board, depending on the boy, nature of the work, and part of the country. Boys whom we sent to the Prairie were generally paid considerably better than those who stayed in British Columbia.

Supervision.

For the purpose of supervising the living and working conditions the Province was divided into seven zones, over each of which was placed a superintendent. Under the superintendent were ranged local committees, and also a local man called a local supervisor, whose duty it was to call on the boy and farmer at frequent intervals, and to straighten whatever difficulties might arise and to make recommendations to the zone superintendent in case any difficulties arose.

Medals.

Public meetings were held at a number of points all over the Province, until such were cancelled by the ban which was placed on public gatherings on account of the influenza epidemic, where "S.O.S." badges were presented to the worthy boys. These boys have shown a great deal of pride in this medal, as it is a recognition of their part in war service.

Conclusion.

The "S.O.S." work in British Columbia was entirely voluntary on the part of our superintendents, local committees, and supervisors, and was therefore subject to the same failings of all voluntary work. The Associate Provincial Superintendent feels, however, that, considering everything, excellent results have been achieved. Over 1,100 boys working on the farms did, without doubt, assist materially in increasing food production, and thereby contribute to winning the war, as requested by the Federal Government.

The Superintendent is very grateful to the Hon. the Minister of Agriculture, the Hon. the Minister of Education, and their assistants, for the valuable co-operation and assistance in carrying out the "S.O.S." programme. Never was anything asked for from either of these Departments that was not given, and given cheerfully.

Respectfully submitted.

JAS. H. BEATTY,
Associate Provincial Superintendent, "S.O.S."

REPORT OF CHIEF POULTRY INSTRUCTOR.

J. R. TERRY.

W. T. McDonald, Esq.,
Acting Deputy Minister, Department of Agriculture, Victoria, B.C.

SIR,—I have the honour to submit herewith our report for the year 1918.

GENERAL CONDITIONS.

Despite the restrictions placed on poultry-feeds by the Food Controller, the poultry industry was able at the end of the year to show a production but a very small percentage less than the previous year. The average price of feedstuffs was higher than during 1917. The matter of rising feed prices is of long standing, however, as evidenced by the following table:—

Price of Feeds.

	1913.	1914.	1915.	1916.	1917.	1918.
Wheat and corn, 100 lb.	$1 75	$ 1 95	$2 20	$2 15	$ 2 25	$3 80
Dry mash, 100 lb.	1 95	1 97	2 80	2 10	2 33	3 00
Wet mash, 100 lb.	2 02	1 93	2 80	2 10	2 33	3 00
Grit and clam-shell, 100 lb.	1 12	1 08	1 10	1 12	1 30	1 25
Beef-scraps, 100 lb.	....	4 50	4 50	4 50	4 50	6 10
Mangels, ton	....	12 00	....	....	12 00	....
Straw, bale	70	65	63	50	65	70

During the spring months weather conditions were on the whole much better than those which prevailed during the same period of 1917. During the hatching period, March and April, the climatic conditions were more favourable than for some years past. There was a long spell of bright, sunny days. Favourable weather during the first two weeks of a chick's life is essential. In practically all parts of the Province the spring and early summer months were very hot and dry, this greatly facilitating the growth and development of the young stock. Owing to the high price of eggs in the spring, very few people packed or preserved as many eggs as they did the year previous, when the prices were much lower.

The number of chicks hatched and reared during the past year would approximate about one-fifth short of the total of 1917.

The commercial man, especially those who culled their flocks very closely, appear to have been a little more satisfied with their year's work than at any time during the war.

Trade with the Prairie Provinces for eggs, day-old chicks, and breeding stock continued to increase.

The egg records made during the winter months at our Egg-laying Contest are beginning to bear fruit. In addition to exporting stock and eggs to the East, stock was also shipped to the Pacific Coast States and to Japan, China, and Hawaii.

During the past year the farmers' markets held periodically in most of the cities throughout the Province have maintained their usefulness, even though in some cases prices charged are no cheaper than those asked at retail stores.

RABBIT-BREEDING.

During the year the boom in rabbit-breeding still continued. Despite the fact that towards the fall a percentage of the beginners desiring to get out of the business somewhat lowered the price of breeding stock, those continuing report an excellent year's business.

During the year the Provincial Association of Rabbit-breeders was formed, and also local associations covering Vancouver and District and Victoria and District. The exhibits of rabbits at Vancouver Exhibition, the Victoria Poultry Show, and the Provincial Show held at Vancouver were by far the largest and best held in any Province west of Ontario.

Fall Fairs.

With the aid of competent Provincial judges, the members of this Division judged the poultry exhibits at the fall fairs and exhibitions. Compared with 1917, most of the shows had a larger number of exhibits, which also excelled the previous year in quality as well. Considerable progress has to be recorded in the matter of improved conditions in connection with the poultry exhibits at the fall fairs. Nearly all of the shows now give classes for single specimens as advised by this Division and the Provincial Poultry Association for years past. As in previous years, the popular breeds were the most numerous shown. It is pleasing also to record the fact that the classes for utility breeders are being well patronized.

Lectures and Demonstrations.

The usual lectures and demonstrations were given to the members of the local Poultry Association, Farmers' and Women's Institutes throughout the Province, as desired.

Provincial Poultry Association.

During the past year the association, despite the continuance of the war and the drain on the manhood of the country, managed to hold its own as regards membership. Three new associations were affiliated and one dropped out. The new associations were Corbin, East Kootenay, Salmon Arm, and Clayburn. The association becoming defunct was Ashcroft.

A big percentage of the local associations continued the co-operative buying of feedstuffs, thereby giving valuable assistance to its members.

The association published its Directory of Breeders as usual, and by advertising through the medium of a number of Provincial papers, and also the farm papers on the Prairies, more copies were sent out than during any other period.

The grouping of district shows was continued, and now that the Provincial Show has been permanently settled in Vancouver, it should be assured of financial success.

The annual convention was again held at the same time and place as the show. Twenty-five associations were represented out of the total of thirty-one. The Provincial Show was the largest held in the Province since it was held in 1911 at Vancouver. The Provincial Association again distributed cash prizes of $5 each to its members competing in the Egg-laying Contest whose pens laid the required number of eggs. Handsomely printed diplomas and fine silk ribbons were also awarded monthly to all competitors qualifying for same. The association presented its members with journal and account books in an endeavour to encourage them to keep closer track of their expenditure and income. Members of the association again did well in the Egg-laying Contests held in various parts of the United States. The writer was, as per constitution, appointed Secretary-Treasurer and Mr. Upton Assistant Secretary.

Egg-laying Contest.

The Seventh Egg-laying Contest ended September 25th, 1918, being of eleven months' duration. The classes were as follows: Class 1, 21 pens; Class 2, 19 pens.

For the first time since the inauguration of the contest seven years ago, the first prize in Class 1 was won by a pen other than White Leghorns. A pen of Mottled Anconas bred and raised in the Province headed the list. All the birds constituting this pen have since been sold to an Ontario breeder for the sum of $300. The first-prize winner in Class 2 was the same breeder that won the Fifth and Sixth Contests. This incident proves more than anything else the importance of both strain and breed.

The usual silver and bronze medals were thoughtfully provided by friends of the contest. The climatic conditions obtaining throughout the contest were an improvement on the year previous. The majority of the fowls, not being needed by their owners, were sold by public auction at the conclusion of the contest. There were five pen entries from the United States—one pen from New Jersey and the others from Oregon and Washington. With the exception of a pen of Leghorns from Ontario, the rest of the entries were British Columbia birds. The report of the contest, together with summary of same, is shown in Appendix No. 24.

BOYS' AND GIRLS' COMPETITIONS.

This, the third season in which the competitions have been held, proved as successful as last year, there being no fewer than twenty-six clubs competing—a total of 257 competitors. Owing to a better season than last, the flocks raised by the competitors were better on the average than in previous years. The usual depredations by birds of prey, coyotes, cats, dogs, rats, minks, etc., were again recorded. The competitors continued to make profitable sales of breeding stock to farmers in their particular vicinity, and the improvement is again noticed in the general flocks kept on the farms. Owing to the influenza epidemic only one visit was made to each club.

The following are the names of clubs organized: Chilliwack No. 1; Chilliwack No. 2; Chilliwack (East); Chilliwack (Lotbiniere); Chilliwack (Central); Comox Bay; Creston; Denman Island; Fort George; Fruitvale; Kamloops; Malakwa; Martin's Prairie; Mission; Needles; Point Grey; Point Grey (Amateur); Tappen; Vancouver (Barred Rocks); Vancouver (Reds); Vancouver (Buffs); Vancouver (Whites); Vancouver (Leghorns); Westbank.

"EGGS MARKS ACT."

During the year the members of this Division have made the usual inspections, a number of these being city markets throughout the Province, with the exception of New Westminster and Vancouver, which come under the jurisdiction of the Coast Markets Commissioner. There appears to be further evidence of the co-operation of the wholesalers and producers in an endeavour to carry out the requirements of the Act.

Owing to the egg shortage elsewhere and the extremely high freight rates, very few importations were made into the Province as compared with other years. With a view to making the Act more effective, quite a number of amendments are being proposed. It is hoped that these will become law at an early date.

PUBLICATIONS.

The demand for bulletins, especially in the early part of the season, was much greater than usual. Owing to the growing importance of the rabbit industry a bulletin and Breeders' Directory was published early in the year. As an evidence of its popularity it might be mentioned that copies have been asked for from all sections of the North American Continent. Particularly numerous were the inquiries from the Provinces of Nova Scotia and Quebec.

The usual monthly reports of the Egg-laying Contest were sent out; articles on poultry subjects were supplied to the newspapers of the Province and the poultry journals of Canada; and special articles were also written for the *Agricultural Journal.*

INSPECTION AND INSTRUCTION WORK.

As often as possible members of this Division have visited poultry-ranchers and city-lot poultry-keepers needing instruction and advice. Mr. Upton, taking advantage of his motor-car, was enabled to make an extremely large number of calls for the year.

POULTRY-DISEASES.

The mildest spring and early summer were not so favourable to the spread of colds and other diseases prevalent the previous year. It is again a pleasure to record the fact that the number of cases of tuberculosis amongst poultry is gradually dwindling. A valuable preventive work has been done by the Department in enforcing the tubercular test for cattle. Practically all cases of this disease amongst fowls can be traced to bovine tubercle bacilli.

The spread of entero-hepatitis (black-head) amongst turkeys is increasing. There are very few flocks in the Province, or for that matter in the Dominion of Canada, that are not affected with this trouble. The members of this Division, wherever possible, advised against the keeping of turkeys on farms of small acreage. Not only is there a great danger of infection amongst the owners' flocks of common fowls, but also amongst the flocks of others situate at a distance.

Coccidiosis is also making its appearance amongst the commercial flocks of the Province. This disease appears more frequently among flocks that are crowded and kept upon soil more or less continuously without giving the land a chance to sweeten up by periodic ploughing and cropping. More attention to sanitation and hygiene should be of valuable assistance in checking this dangerous disease.

Office-work.

This phase of the work has again increased, more especially during the period covered by the announcement of the armistice to the end of the year. The number of returned soldiers calling for advice is becoming very great, and the work developing out of the Secretaryship of the Poultry Association also shows no sign of diminishing. The clerical work incidental to the duties of the members of this Division has also shown an increase.

In conclusion, allow me to again testify to the able assistance of H. E. Upton in the work of the Division, and also to acknowledge the services of W. H. Stroyan, the poultryman in charge of the Egg-laying Contest.

Respectfully submitted.

J. R. Terry,
Chief Poultry Instructor.

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APPENDICES.

APPENDIX No. 1.

IMPORTED FRUIT, POTATOES, ETC., INSPECTED AT VANCOUVER, 1917 AND 1918.

	1917.	1918.
Apples (boxes)	67,723	79,243
„ (½ boxes)	19	342
„ (bbls.)	2	.....
Crab-apples (boxes)	9	25
„ (½ boxes)	142	.....
Pears (boxes)	13,459	16,153
„ (½ boxes)	2	185
Plums (boxes)	11,200	8,853
Prunes (boxes)	87	1
Peaches (boxes)	56,153	42,006
Apricots (boxes)	6,350	26,770
Nectarines (boxes)	5	.....
Quince (boxes)	68	.....
Cherries (boxes)	6,883	5,431
California oranges (boxes)	103,877	47,914
Japanese oranges (boxes)	66,813	202,162
„ (shipped out) (boxes)	.....	117,495
Chinese oranges (boxes)	119	169
Tangerines (boxes)	.....	10
„ (½ boxes)	5	.....
Lemons (boxes)	14,500	14,527
Grapefruit (boxes)	4,252	7,496
Limes (boxes)	4	.....
Pineapples (boxes)	189	165
Pomeloes (boxes)	254	5
Persimmons (boxes)	180	.....
Pomegranates (boxes)	201	25
Peppers (boxes)	2,228	168
Egg-plants (boxes)	265	12
Tomatoes (½ boxes)	2,950	2,011
Potatoes (crates)	9,912	82
„ (bulk and sacks) (tons)	1,530	7,942
Sweet potatoes (crates)	3,093	2,703
Yams (crates)	120	407
Taro (crates)	.....	812

APPENDIX No. 2.

Imported Fruit, Potatoes, etc., condemned at Vancouver, 1917 and 1918.

	1917.	1918.
Apples (boxes)	5,242	8,362
„ (½ boxes)	1	25
„ (bbl.)	1	.....
Crab-apples (boxes)	6	24
Pears (boxes)	632	6,833
Plums (boxes)	145	.....
Peaches (boxes)	70	40
Cherries (boxes)	23	.....
Tangerines (½ box)	1	.....
Japanese oranges (boxes)	2,060	6
California oranges (boxes)	94	.....
Grapefruit (boxes)	12	.....
Potatoes (pkg.)	.....	1
„ (sacks)	12	.....
„ (crates)	9,764	.....
„ (tons)	174	.....
Sweet potatoes (box)	1	.....
Yams (boxes)	20	.....
Nutmegs (cases)	18	191
„ (200-lb. sacks)	.....	12

APPENDIX No. 3.

Imported Fruit, Potatoes, Corn, etc., inspected at all Ports of Entry in British Columbia, 1917 and 1918.

	1917.	1918.
Apples (boxes)	92,288	100,213
„ (½ boxes)	146	467
„ (bbls.)	2	2
Crab-apples (boxes)	98	39
„ (½ boxes)	142	.....
Pears (boxes)	18,091	18,007
„ (½ boxes)	17	229
Plums (boxes)	15,846	11,099
Prunes (boxes)	2,427	515
Peaches (boxes)	76,594	55,665
Apricots (boxes)	7,981	29,296
Nectarines (boxes)	25	.....
Quince (boxes)	76	1
Cherries (boxes)	8,940	6,621
California oranges (boxes)	144,962	65,234
Japanese oranges (boxes)	80,931	99,364
Chinese oranges (boxes)	199	169
Tangerines (boxes)	30	65
„ (½ boxes)	5	.....
Lemons (boxes)	20,291	19,719
Grapefruit (boxes)	6,302	10,052
Limes (boxes)	8	2
Pineapples (boxes)	234	247
Pomeloes (boxes)	408	20
Persimmons (boxes)	210	.....
Pomegranates (boxes)	226	25
Tomatoes (boxes)	5,847	3,630

APPENDIX No. 3—*Concluded.*

IMPORTED FRUIT, POTATOES, CORN, ETC., INSPECTED AT ALL PORTS OF ENTRY—*Concluded.*

	1917.	1918.
Peppers (boxes)	3,333	241
Egg-plants (boxes)	330	15
Sweet potatoes (boxes)	4,023	3,503
Yams (baskets)	120	548
Taro (baskets)	.....	969
Potatoes, U.S.A. (sacks)	16,931	274
„ „ (tons)	684	8,067
„ Orient (crates)	9,912	82
„ (baskets)	94	.....
Vetch (lb.)	.....	100
Rye (bushels)	.....	9
Rice (tons)	.....	42,630
Corn (tons)	.....	4,415
Beans (tons)	.....	3,249
Peas (tons)	.....	1,737
Australian wheat (long tons)	.....	11,684

APPENDIX No. 4.

VEGETABLES, FRUIT, NUTS, ETC., FOR WHICH NO CERTIFICATES WERE ISSUED, 1918.

	Crates, etc.
Artichokes	83
Asparagus	2,057
Beans (green)	60
Beets	198
Cabbage	5,568
Cantaloupes	8,554
Carrots	2,002
Casabas	366
Cauliflower	3,903
Celery	2,259
Corn	121
Cress	2
Cucumbers	676
Garlic	6
Ginger	1
Horse-radish	4
Lettuce	8,223
Melons	6,949
Mint and watercress (mixed)	1
Onions	12,566
Parsley	52
Parsley, peas, beans, and sprouts (mixed)	22
Peas (green)	240
Peas and beans (mixed)	13
Peas, beans, and sprouts (mixed)	26
Radish	103
Radish and parsley (mixed)	1
Rhubarb	2,864
Spinach	153
Sprouts	28

APPENDIX No. 4—*Concluded.*

VEGETABLES, FRUITS, NUTS, ETC., FOR WHICH NO CERTIFICATES WERE ISSUED—*Concluded.*

	Crates, etc.
Squash	300
Turnips	482
Bananas (bunches)	29,672
Gooseberries	31
Grapes	20,510
Cranberries	147
Loganberries	6
Raspberries	68
Strawberries	5,483
Almonds	420
Chestnuts	2
Nuts (mixed)	2
Peanuts (lb.)	3,070,900
Walnuts	900

APPENDIX No. 5.

IMPORTED FRUIT, POTATOES, ETC., CONDEMNED AT ALL PORTS OF ENTRY IN BRITISH COLUMBIA, 1917 AND 1918.

	1917.	1918.
Apples (boxes)	6,894	10,512
„ (½ boxes)	1	25
„ (bbl.)	1	.....
Crab-apples (boxes)	6	24
Pears (boxes)	717	7,173
Plums (boxes)	145	.....
Peaches (boxes)	79	42
Apricots (boxes)	3	5
Cherries	27	5
California oranges (boxes)	94	.....
Japanese oranges	2,060	6
Tangerines (½ box)	1	.....
Grapefruit (boxes)	21	.....
Tomatoes (boxes)	61	12
Yams (crates)	20	.....
Sweet potatoes (crates)	3	1
Potatoes (pkg.)	.....	1
„ (sacks)	12	.....
„ Australian (crates)	9,764	.....
„ „ (shrinkage from decay) (tons)	174	.....
Nutmegs (cases)	18	191
„ (200-lb. sacks)	.....	12

APPENDIX No. 6.

IMPORTED RICE, BEANS, PEAS, CORN, ETC., INSPECTED AT VANCOUVER, 1917 AND 1918.

	1917. Tons.	1918. Tons.
227,617 50-lb. sacks rice 157,252 100-lb. „ 50 110-lb. „ 17,596 112-lb. „ 19,771 200-lb. „ 3,680 220-lb. „ 153,370 224-lb. „ 134 240-lb. „ 185 250-lb. „ 71,195 50-lb. „	21,090	35,919
1,432 50-lb. sacks beans 62,671 100-lb. „ 3 130-lb. „ 40 150-lb. „ 278 185-lb. „	2,984	3,198
15,164 100-lb. sacks peas 558 180-lb. „ 9,027 200-lb. „ 4 100-lb. pkgs. peas	1,224	1,711
2 50-lb. sacks corn 1,700 100-lb. „ 2 150-lb. „ 6,484,370 lb. bulk corn 77 100-lb. sacks popcorn	1,838	3,331
The following were fumigated:—		
8,372 50-lb. sacks rice 2,721 100-lb. „	256	345
(165 bundles empty 100-lb. rice-sacks.)		
22 50-lb. sacks beans 1,181 100-lb. „	178	59
910 100-lb. sacks peas	226	45
Corn	152	...
1,719 100-lb. bags peanuts 5,210 100-lb. „ 5,339 100-lb. „	25	613
36,730 lb. Australian wheat tailings.		
15,000 empty wheat-sacks.		
Australian wheat tailings ex S.S. "Jean Steadman."		
13,159 empty Australian wheat-sacks ex S.S. "Marie Barnard."		
39,710 lb. Australian wheat screenings ex S.S. "Marie Barnard."		
102 bundles mats ex S.S. "Protesilaus."		
12 140-lb. barrels coriander-seed.		
165 bales rabbit-skins (18 tons).		

IMPORTED RICE, BEANS, PEAS, ETC., INSPECTED AT VICTORIA, 1917 AND 1918.

	1917.	1918.
Rice (¼ tons)	8,760	6,711
Corn (tons)	523	1,083
Beans (¾ tons)	105	50
Peas (tons)	85	25
The following were fumigated:—		
Rice (½ tons)	1,259	1,232
Peanuts (tons)	....	84

APPENDIX No. 7.

Imported Nursery Stock inspected at Vancouver, 1917 and 1918.

	1917.	1918.
Standard fruit-trees—		
Apple	37,665	33,642
Crab	693	1,042
Pear	6,032	6,347
Cherry	4,798	7,922
Plum	2,783	4,011
Prune	3,797	2,420
Peach	3,204	2,498
Quince	182	227
Nectarine	196	73
Apricot	6,022	5,311
Fig	78	31
Mulberry	89	123
Nut-trees—		
Walnut	896	451
Filbert	276	100
Chestnut	186	75
Almond	33	13
Ornamental and fruit	169,456	.....
„ „	21,418	.....
Seedlings and scions—		
Fruit seedlings	.....	223,566
Fruit scions	.....	41,116
Small-fruit bushes and plants—		
Grape-vines	3,063	3,581
Currant-bushes	4,820	1,247
Gooseberry-bushes	5,580	4,416
Raspberry-bushes	10,010	3,293
Blackberry-bushes	9,411	19,796
Strawberry-plants	122,212	56,674
Miscellaneous—		
Ornamental trees, etc.	21,944	97,887
Ornamental seedlings	.....	33,550
Ornamental scions	.....	126,400
Rose-bushes	26,215	44,332
Plants	17,458	64,404
Bulbs and roots	386,394	507,936
Totals	864,911	1,292,484

APPENDIX No. 8.

IMPORTED NURSERY STOCK CONDEMNED AT VANCOUVER, 1917 AND 1918.

	1917.	1918.
Apple-trees	1,691	1,739
Crab-trees	100	100
Pear-trees	692	238
Cherry-trees	35	56
Plum-trees	40	25
Prune-trees	18	37
Peach-trees	49	7
Quince-trees	13	5
Nectarine-tree	.....	1
Mulberry-trees	7	19
Apricot-trees	723	21
Walnut-trees	4	....
Filbert-trees	1	2
Chestnut-trees	75	1
Fruit seedlings	.....	131
Ornamental and fruit	2,505	....
Grafts	600	....
Grape-vines	352	614
Currant-bushes	47	36
Gooseberry-bushes	175	421
Raspberry-bushes	2,175	33
Blackberry-bushes	262	231
Ornamental trees, shrubs	211	104
Ornamental seedlings	.....	100
Rose-bushes (1,110 dead)	44	1,223
Plants	138	1
Bulbs and roots	7	....
Total condemned	9,964	5,145

APPENDIX No. 9.

British Columbia Dairymen's Association, Season's Butter Competition, 1918.

Class 1.—Best Box of June Butter.

Prize.	Amount.	Donated by	Won by	Score.
1st	$25 00	Fraser Valley Milk Producers' Association, Vancouver	F. L. Wheeler, Saltspring Island	96.5
2nd	15 00	A. P. Slade & Co., Vancouver	J. M. Livingstone, Vancouver	96.0
3rd	10 00	A. P. Slade & Co., Vancouver	D. A. James, Vancouver	95.5

Class 2.—Best Box of July Butter.

1st	$25 00	W. H. Malkin Co., Ltd., Vancouver	J. M. Livingstone, Vancouver	96.25
2nd	15 00	Vancouver Creamery, Ltd., Vancouver	D. A. James, Vancouver	96.0
3rd	10 00	„ „	S. J. Thomas, Kelowna	95.0

Class 3.—Best Box of August Butter.

1st	$25 00	F. R. Stewart & Co., Victoria	D. A. James, Vancouver	96.75
2nd	15 00	McQueen Produce Co., Ltd., Vanc'r.	J. M. Livingstone, Vancouver	96.50
3rd	10 00	„ „	Hollis Newton, Vancouver	96.25

Class 4.—Best Box of September Butter.

1st	$25 00	Canadian Produce Co., Vancouver	J. M. Livingstone, Vancouver	97.0
2nd	15 00	Standard Milk Co., Ltd., Vancouver	F. L. Wheeler, Saltspring Island	96.5
3rd	10 00	„ „	S. J. Thomas, Kelowna	96.25

Class 5.—Best Box of October Butter.

1st	$25 00	P. Burns & Co., Ltd., Vancouver	J. M. Livingstone, Vancouver	97.5
2nd	15 00	The DeLaval Dairy Co., Vancouver	D. A. James, Vancouver	97.25
3rd	10 00	„ „	Hollis Newton, Vancouver	96.5

"Wyandotte Special," Best Average Score, June to August.

Gold watch and chain	J. B. Ford Co., Wyandotte, Mich	J. M. Livingstone, Vancouver	96.25

"Season's Championship," Best Average Score, June to October.

Gold medal or gold watch	B.C. Dairymen's Association	J. M. Livingstone, Vancouver	96.65
Silver medal	„ „	D. A. James, Vancouver	96.30
Gold cuff-links	„ „	F. L. Wheeler, Saltspring Island	96.01

Butter-judging Competition.

1st	$25 00	Davis-Watkins Manufacturing Co., Denver, Col.	M. R. Silver, Vancouver	....
2nd	15 00	Alberta Dairy Supplies, Ltd., Edm't'n.	D. A. James, Vancouver	....
3rd	10 00	„ „	F. L. Wheeler, Saltspring Island	....
4th	5 00	„ „	H. S. Batey, Armstrong	....

APPENDIX No. 10.

LIST OF CREAMERIES IN BRITISH COLUMBIA.

Name.	Secretary or Manager.	Address.
Burns, P., & Co., Ltd.	M. R. Silver	Woodland Drive, Vancouver.
Chilliwack Creamery	W. K. MacLeod	Chilliwack.
Comox Creamery Association	R. U. Hurford	Courtenay.
Cowichan Creamery Association	W. Paterson	Duncan.
Curlew Creamery Co.	Geo. W. Smith	Nelson.
" "	R. E. Jenne	Grand Forks.
Clayburn Creamery Co.	Cooper & Seldon	Clayburn.
Heffley Creamery	Thos. Bunting	Heffley Creek.
Kamloops District Creamery Association	W. Van der Wall	Kamloops.
Kelowna Creamery Co., Ltd.	W. G. Benson	Kelowna.
Meadowbrook Creamery	A. P. Slade	199 Water Street, Vancouver.
Nanaimo Creamery Association	Jos. Randle	Nanaimo.
Northwestern Creamery, Ltd.	Norton & Snelling	Victoria.
North Okanagan Creamery Association	A. E. Sage	Armstrong.
Oxford Dairy Co., Ltd.	J. Burmeister	New Westminster.
New Westminster Creamery Co.	D. E. Mackenzie	"
Revelstoke Creamery Co., Ltd.	J. E. Carmen	Revelstoke.
Fraser Valley Milk Producers' Ass'n.	E. G. Sherwood	1327 Standard Bank Building, Vanc'r.
Royal Dairy Co.	C. W. McAllister	Douglas Street, Victoria.
"	A. A. Young	1001 Pender Street West, Vancouver.
Saltspring Island Creamery Association	F. L. Wheeler	Ganges Harbour, S.S.I.
Salmon Arm Creamery Association	R. Karnagel	Salmon Arm.
Spencer, David, Ltd.	W. S. Smith	Vancouver.
Standard Milk Co., Ltd.	E. W. Clark	405 Eighth Avenue West, Vancouver.
Turner's Dairy, Ltd.	F. Turner	Seventeenth Ave. and Ontario St., Van.
Vancouver Creamery Co., Ltd.	J. M. Livingstone	15 Alexander Street, Vancouver.
Condensers.		
B.C. Milk Condensing Co., Ltd.	L. Chevalley	Sardis.
Courtenay Milk Condensing Co., Ltd.	E. G. Emery	Courtenay.
Pacific Milk Co., Ltd.	B. W. Keating	Ladner.
Cheese-factories.		
Fraser Valley Milk Producers' Ass'n.	E. Haggerty	Sardis.
Revelstoke Creamery Co., Ltd.	J. E. Carmen	Revelstoke.
Ferrera Cheese Manufacturing Co.	A. G. Ferrera	Chilliwack.

APPENDIX No. 11.

SUMMARY OF CREAMERY REPORT, 1918.

Number of creameries	26
Number of patrons	1,946
Number of visits to creameries	55
Number of creameries using pasteurizer	14
Average per cent. of fat in cream	27-30
Average per cent. of moisture in butter	15-15½
Average amount of salt per pound of butter	⅝ oz.
Number of creameries using Babcock test	26
Number of creameries using cream-scales (metric)	26
Number of creameries testing each delivery of cream separately	10
Number of creameries using composite samples	16
Number of creameries having mechanical refrigeration	9
Average temperature of storages	45° Fahr.
Number of creameries having poor water-supply	2
Expenditure, new equipment and general improvements	$18,448

APPENDIX No. 12.

List of Prize-winners, Cow-testing Associations, 1918.

Comox Valley Cow-testing Association.

Rank.	Name of Cow and Breed.	Owner.	Address.	Milk.	Butter-fat.
	Two Years old.			Lb.	Lb.
1	Nora of Avelreagh, Jersey	G. Hornby	Sandwick	7,945	414.9
2	Leoni of Avelreagh, Jersey	T. D. Smith	„	6,620	388.6
3	Mabel, Jer. Gr.	R. U. Hurford	Courtenay	7,671	387.4
	Three Years old and over.				
1	Dell 2nd of Blue Ribbon, Jersey	T. D. Smith	Sandwick	9,362	600.7
2	Italia of Blue Ribbon, Jersey	W. T. Wain	Courtenay	9,535	503.5
3	Roxy of Maplehurst, Jersey	T. D. Smith	Sandwick	7,781	495.8

Delta Cow-testing Association.

	Two Years old.				
1	Delta Pietje, Holstein	Alex. Davie	Ladner	11,245	378.6
2	Paleface, Hol. Gr.	Heard Bros.	„	7,577	318.9
3	Daisy, Hol. Gr.	H. Burr	„	7,699	317.1
	Three Years old and over.				
1	Belle, Hol. Gr.	Alex. Davie	„	15,980	605.2
2	Hol. Gr.	„	„	21,989	604.0
3	„	„	„	15,792	561.2

Chilliwack Cow-testing Association.

	Two Years old.				
1	Flossie, Guernsey	C. Hawthorne	Chilliwack	8,807	497.2
2	Favourite, Holstein	S. Mercer	Rosedale	11,802	421.4
3	Molly, Jer. Gr.	E. D. Barrow	Chilliwack	5,721	297.7
	Three Years old and over.				
1	Nancy 3rd, Ayrshire	J. S. Higginson	Sardis	10,813	474.7
2	John H., Guernsey	C. Hawthorne	Chilliwack	10,374	470.7
3	Flossie, Jer. Gr.	S. W. Keith	„	11,258	467.3

Langley-Surrey Cow-testing Association.

	Two Years old.				
1	Nellie, Reg. Ayr.	Shannon Bros.	Cloverdale	10,252	378.5
2	Alma Mater's Dewdrop, Hol. Reg.	F. V. Worrell	Milner	9,642	363.5
3	Queenie, Hol. Gr.	H. Buseman	Murrayville	6,096	314.7
	Three Years old and over.				
1	Grandview Rose, Ayr. Reg.	Shannon Bros.	Cloverdale	22,228	896.2
2	Princess Tulip, Hol. Reg.	F. V. Worrell	Milner	16,448	545.6
3	"No. 5," Hol. Reg.	L. H. Delesalle	Matsqui	15,468	471.3

APPENDIX No. 13.

MILK-TESTERS LICENSED UNDER "DAIRIES REGULATION ACT," 1918.

Name.	Address.
Barker, P. S.	507 Twenty-ninth Avenue East, Vancouver.
Batey, Herbert S.	Armstrong.
Boughtwood, Geo.	Valley Dairy, Vancouver.
Bubar, D. T.	Courtenay.
Bunting, Thos.	Heffley Creek.
Burmeister, J.	Oxford Dairy, New Westminster.
Campbell, A. M.	Fraser Valley Dairy, Vancouver.
Carman, J. E.	Revelstoke.
Carradice, F. W.	1754 Fifth Avenue West, Vancouver.
Carroll, W. J.	Courtenay.
Carter, J. N.	Turner's Dairy, Vancouver.
Chevalley, Frank	Sardis.
Craig, John	Cowichan Creamery, Victoria.
Cranswick, P.	Royal Dairy, Vancouver.
Clarke, F. J.	850 Fourteenth Avenue East, Vancouver.
Dudman, Alfred	Meadowbrook Creamery, Vancouver.
Dunn, J. S.	Nanaimo.
Emery, E. G.	Courtenay.
Fish, Amos	131 Fifteenth Avenue West, Vancouver.
Fish, James	East End Dairy, Vancouver.
George, H. H. S.	Kamloops.
Gillman, R. H.	Northwest Creamery, Victoria.
Hall, F. D. B.	Chilliwack.
Hanson, H. M.	Matsqui.
Iwanami, J.	City Dairy, Victoria.
James, David A.	Standard Milk Co., Vancouver.
Jenne, R. Everett	Grand Forks.
Johnson, Alfred	Salmon Arm.
Karnagel, R.	"
Kell, George	New Westminster.
Lewarne, A. E.	City Dairy, Vancouver.
Livingstone, J. M.	Vancouver Creamery, Vancouver.
McAllister, W. C.	Royal Dairy, Victoria.
MacKenzie, H. H.	New Westminster.
MacLeod, W. K.	Chilliwack.
Magar, J. A.	Kamloops.
Matheson, W. D.	Spencer's Creamery, Vancouver.
Metcalfe, John F.	3436 Oak Street, Vancouver.
Nelson, C. E.	2144 Twelfth Avenue West, Vancouver.
Norton, F. H. A.	Northwestern Creamery, Victoria.
Rive, Chas.	2226 Twelfth Avenue West, Vancouver.
Rive, Elias	" " "
Russell, Geo. F.	Courtenay.
Sejrup, V. M.	Duncan.
Sellers, Jas. H.	City Dairy, Vancouver.
Sherwood, E. G.	1327 Standard Bank Building, Vancouver.
Silver, M. R.	care P. Burns & Co., Ltd., Vancouver.
Smith, Geo. W.	Nelson.
Smith, W. S.	Spencer's Creamery, Vancouver.
Thomas, S. J.	Kelowna.
Thornbery, G. H.	Courtenay.
Turner, L. H.	Turner's Dairy, Ltd., Vancouver.
Van der Wall, W.	Kamloops.

APPENDIX No. 13—*Concluded.*

Milk-testers licensed under "Dairies Regulation Act"—*Concluded.*

Name.	Address.
Washington, F. J.	1170 Hornby Street, Vancouver.
Watson, J. B.	Sardis.
Wells, Bruce	Ladner.
Wheeler, F. L.	Ganges.

APPENDIX No. 14.

Creamery or Dairy Licences under "Dairies Regulation Act," Chapter 16, 1916, for the Year 1918.

Name.	Address.
Beaconsfield Dairy	905 Twenty-fourth Avenue East, Vancouver.
B.C. Milk Condensing Co., Ltd.	Sardis.
Burns & Co., Ltd., P.	Woodland Drive, Vancouver.
Chilliwack Creamery Association	Chilliwack.
City Dairy & Produce Co., Ltd.	414 Pender Street East, Vancouver.
Comox Creamery Association	Courtenay.
Courtenay Condensed Milk Co., Ltd.	„
Clayburn Creamery	Clayburn.
Cowichan Creamery Association	Duncan.
Curlew Creamery Co.	Grand Forks.
„ „	Nelson.
East End Dairy	2469 Oxford Street, Vancouver.
Fraser Valley Dairy	1170 Hornby Street, Vancouver.
Fraser Valley Milk Producers' Association	1327 Standard Bank Building, Vancouver.
Grandview Dairy	1170 Semlin Drive, Vancouver.
Heffley Creamery	Heffley Creek.
Hillcrest Dairy	131 Fifteenth Avenue West, Vancouver.
Independent Farmers' Dairy	1754 Fifth Avenue West, Vancouver.
Kamloops District Creamery Association	Kamloops.
Kelowna Creamery Co., Ltd.	Kelowna.
Mainland Dairy	971-977 Nineteenth Avenue West, Vancouver.
Meadowbrook Creamery	199 Water Street, Vancouver.
Nanaimo Creamery Association	Nanaimo.
New Westminster Creamery Society	New Westminster.
Northwestern Creamery, Ltd.	Victoria.
Northern Okanagan Creamery Association	Armstrong.
North Vancouver Dairy	168 Fourth Street East, North Vancouver.
Oxford Dairy, Ltd.	Sixth Avenue and Sixth Street, New West-
Pacific Milk Co., Ltd.	332 Drake Street, Vancouver. [minster.
Pioneer Dairy	1270 Hornby Street, Vancouver.
Revelstoke Creamery Co., Ltd.	Revelstoke.
Royal Dairy Co.	1001 Pender Street West, Vancouver.
„	Douglas Street, Victoria.
Salmon Arm Creamery Association	Salmon Arm.
Saltspring Island Creamery Association	Ganges Harbour, Saltspring Island.
Standard Milk Co., Ltd.	405 Eighth Avenue West, Vancouver.
Spencer, Ltd., David	Vancouver.
South Vancouver Milk Co.	537 Twenty-ninth Avenue East, Vancouver.
Steves' Dairy, J. M.	2144 Twelfth Avenue West, Vancouver.
Turner's Dairy, Ltd.	Seventeenth Ave. and Ontario St., Vancouver.
Vancouver Creamery Co., Ltd.	23 Alexander Street, Vancouver.
Victoria City Dairy Co.	Fort Street, Victoria.
Valley Dairy, Ltd.	1569 Sixth Avenue West, Vancouver.
White Lunch, Ltd.	124 Hastings Street West, Vancouver.

APPENDIX No. 15.

TUBERCULIN TESTS.

Name of Place.	Premises.	No. Tested.	No. of Reactors.
Armstrong	55	233	1
Nob Hill	2	6	..
Kamloops	3	76	2
Kelowna	64	256	2
Okanagan Landing	2	12	..
Shuswap	2	31	..
Rutland	25	80	..
Columbia Gardens	1	3	..
Eburne	1	22	..
Natal	26	36	6
Nelson	3	8	1
Revelstoke	25	191	..
Pritchard	4	2	1
Notch Hill	2	7	1
Edgewood	1	6	1
Kootenay Bay	1	5	..
Salmon Arm	56	270	..
Phoenix	12	51	..
Greenwood	6	57	..
Creston	3	7	1
Vernon	2	4	..
Galena	4	12	..
Parson	9	22	..
Nicholson	12	58	10
Rossland	32	141	4
Penticton	22	2	1
Castledale	14	42	1
Brisco	8	14	..
Invermere	8	26	..
Wilmer	3	4	..
Athalmer	6	19	..
Windermere	3	9	..
Enderby	11	50	..
New Westminster	15	..	..
Chase	15	..	..
Larkin	1	..	..
Nakusp	1	..	..
Trail	3	..	..
Field	2	..	..
Keremeos	2	..	..
Princeton	3	..	..
Hedley	2	..	..
Midway	5	..	..
Naramata	3	..	..
Ducks	1	..	..
Celista	1	..	..
Hornby Island	18	121	1
Denman Island	3	37	..
Cumberland	2	10	1
Duncan	21	230	3
Ladysmith	80	482	12
Brentons	6	15	..
Yellow Point	2	12	..
Nanaimo River	42	306	10
Nanaimo	107	670	18
South Wellington	5	41	1
Hilliers	1	6	..
Westholme	25	269	12
Chemainus	10	64	..
Comox	38	601	48
Cobble Hill	6	132	1
Saanich	117	744	65
Victoria	38	285	12
Pender Island	3	40	..
Moresby Island	1	30	..

APPENDIX No. 15—*Concluded.*

TUBERCULIN TESTS—*Concluded.*

Name of Place.	Premises.	No. Tested.	No. of Reactors.
Essondale	1	231	5
Chilliwack	517	6,122	152
Cloverdale	21	359	13
Colebrook	9	126	3
Langley	29	386	21
Matsqui	3	16	1
Agassiz	3	66	..
Aldergrove	5	66	..
Abbotsford	2	22	..
Silverdale	3	41	2
Dewdney	3	89	..
Vancouver	125	316	24
Ladner	58	593	20
Westminster	43	705	35
Steveston	12	150	10
Point Grey	9	68	7
Queensborough	3	25	5
Eburne	33	191	18
Pitt Meadows	1	23	..
Mount Lehman	1	11	1
Glen Valley	2	20	..
Barnston Island	8	106	8
Clayburn	1	5	..
Newton	1	7	..
North Bend	6	24	2
Bowen Island	1	2	1

APPENDIX No. 15A.

BRANDS.

B brands issued	594
A brands issued	384
Brands cancelled	3
Brands transferred	25

APPENDIX No. 16.

STOCK AND EQUIPMENT ON QUILCHENA DRY-FARMING STATION, DECEMBER 31ST, 1918.

	Estimated Value.
Horses—	
1 aged mare	$ 150 00
2 mares, 9 years old, $150 each	300 00
1 mare, 4 years old	200 00
1 gelding, 1 year old	75 00
1 gelding, 3 years old	200 00
2 mare colts, $75 each	150 00
1 cow	100 00
1 heifer	50 00
2 hogs, $15 each	30 00
4 rams, $50 each	200 00
100 ewes, $20 each	2,000 00
25 ewes, $19 each	475 00
13 ewes, $12 each	156 00
Harness—	
2 sets heavy harness	90 00
Implements—	
1 heavy wagon, 4-inch tire and box	100 00
1 set bob-sleighs	30 00
1 6-foot Massey-Harris binder	165 00
1 I.H.C. land-packer, 2,000 lb.	125 00
1 Massey-Harris 11-shoe drill	50 00
1 disk harrow	25 00
1 set drag-harrows, 3-section lever	25 00
1 Verity combination plough	28 00
1 Planet horse-hoe	10 00
1 Oliver plough	10 00
1 grinding-stone	5 00
1 No. 25 Planet garden-seeder	10 00
1 Chatham fanning-mill	40 00
1 set farm scales, capacity 2,000 lb.	35 00
1 new mower, Emerson	80 00
2 4-inch by 6-foot hotbed-sashes	5 00
1 chop-mill	40 00
Blacksmith's outfit—	
1 Chicago portable forge	10 00
1 anvil	5 00
1 hammer	1 00
1 pair tongs	1 00
Horse-shoeing outfit—	
1 hammer	1 00
2 pairs pincers	1 00
1 paring-knife	25
1 rasp	25
Hand-tools—	
1 scoop shovel	50
2 long-handled shovels	1 00
1 short-handled shovel	75
1 spade	50
2 stable-forks	2 00
3 hay-forks	2 00
1 pinch-bar	1 25
1 bar-stud	2 00

APPENDIX No. 16—*Continued.*

STOCK AND EQUIPMENT ON QUILCHENA DRY-FARMING STATION—*Continued.*

	Estimated Value.
Hand-tools—*Concluded.*	
1 pick	$ 2 00
1 steel hammer	75
1 splitting-maul	1 00
3 wedges	75
2 axes	3 00
1 5-foot lance-toothed saw	2 00
1 fence-wire stretcher	10 00
1 logging-chain	3 00
Carpenter's Tools—	
1 hand-saw	1 00
1 steel square	1 00
1 set brace and bits	2 00
1 hammer	1 00
2 chisels	1 00
Buildings—	
1 granary, 14 x 26 feet x 8-foot wall	150 00
1 stable, 20 x 40 feet x 7-foot wall	200 00
1 bunk-house, 12 x 12 feet x 8-foot wall	70 00
1 cabin (2 rooms), 12 x 10 feet and 10 x 12 feet x 6-foot wall	125 00
1 tent, 12 x 16 feet	10 00
1 tent, 14 x 16, with flies	25 00
1 sheep-shed, 20 x 40 x 7 feet	100 00
Household effects—	
1 Atlin stove	15 00
1 three-quarter bed, springs and mattress	11 00
2 camp-cots	2 00
4 pairs blankets	5 00
2 pillows	1 00
Pots, pans, etc.	2 00
Miscellaneous—	
1 10-foot pump	9 00
1 barrel	1 00
2 water-tubs	50
Fencing—	
Fences erected, 580 rods	300 00
Fence-wire, 900 rods (woven)	400 00
„ 400 „ (barbed)	160 00
„ 79 „ (woven)	65 00
1 extra wire put on 2-mile fence	86 00
Hay and feed—	Tons.
1 stack green hay	5
7 „ „	3
4 ⅞ acres fall wheat (good).	
5 ⅛ acres fall rye (good).	
300 bushels oats.	
1 stack oat-sheaves	5
2 loads unthreshed peas.	
Roots—	
Turnips	4½
Carrots	1½
Sugar-beets	2
Potatoes	2½
3 acres rape pasture.	

APPENDIX No. 16—*Concluded.*

STOCK AND EQUIPMENT ON QUILCHENA DRY-FARMING STATION—*Concluded.*

Weather-observation instruments—
- 1 wet- and dry-bulb thermometer.
- 1 minimum thermometer.
- 1 maximum thermometer.
- 1 rain-gauge.
- 1 screen.
- 1 Carbine camera and tripods. Returned, property of Water Rights Branch.

APPENDIX No. 17.

STOCK AND EQUIPMENT, 105-MILE DRY-FARMING STATION, NOVEMBER 25TH, 1918.

Buildings—
- 1 horse-barn, 18 x 36 feet.
- 1 lean-to barn, 18 x 13 feet.
- 1 cottage, 20 x 24 feet.
- 1 granary, 20 x 24 feet.
- 2 lumber granaries, 10 x 8 feet.
- 1 root-house.
- 1 chicken-house, 11 x 14 feet.
- 1 wood-shed, 12 x 15 feet.
- 1 stock-shed, 16 x 32 feet.
- 1 implement-shed, 15 x 50 feet.
- 1 stock-yard, 8,400 square feet.
- 2 corrals.
- 1 stockyard, 11,025 square feet.

Live stock—
- 2 grade mares, 4 and 10 years old.
- 1 grade gelding, 8 years old.
- 1 colt, 7 months old.

Implements—
- 1 6-foot binder with truck and transport truck.
- 1 grain-cradle.
- 1 5-foot mower.
- 1 9-foot rake.
- 1 single-disk drill.
- 1 packer.
- 1 3-section lever harrow with two drawbars.
- 1 harrow-cart.
- 1 disk harrow with truck.
- 1 Oliver sulky plough, with 2 bottoms and 3 shares.
- 1 Planet, Jr. cultivator.
- 1 „ „ and seeder (garden).
- 1 hand-cultivator.
- 1 Cyclone cultivator.
- 1 wagon.
- 1 set sleighs.

Tools—
- 1 hoe.
- 1 garden-spade
- 1 wheelbarrow.

APPENDIX No. 17—*Continued.*

Stock and Equipment, 105-Mile Dry-farming Station—*Continued.*

Tools—*Concluded.*

6 forks (5 hay and 1 manure).
1 watering-can.
1 set brace and bits.
2 augers.
1 5-foot saw.
2 hand-saws (rip and crosscut).
1 draw-knife.
4 axes (1 bench and 3 double-bit).
1 D.P. shovel.
1 long-handled shovel.
2 hammers.
1 wire-stretcher and 30 feet rope.
100 feet ¾-inch rope.
4 wrenches.
2 pairs pliers.
1 hay-rack.
1 crowbar.
1 pick.
1 log-chain.
2 files.
1 rasp.
1 comb and brush (stable).
1 scythe.
2 blast-lanterns.
2 sets harness.
7 halters.
1 pump.
1 branding-iron.
1 tape measure.
1 steel square.
1 set scales.
1 8-lb. sledge-hammer.
1 wedge and pair iron dogs.
1 grindstone and fixtures.
360 yards stake and rider fence.
1,706 yards barb-wire fence, 4 wires high, posts 20 feet apart.
816 „ „ 5 „ „ 18 „
726 „ „ 4 „ „ 20 „
1,550 „ „ 3 „ „ 20 „
1,320 yards woven-wire fence, 3 barb wires on top, posts 18 feet apart.
280 „ „ 3 „ „ „ 20 „
390 „ „ 1 „ „ „ 20 „
260 „ „ 1 between and 1 on top, posts 20 feet apart.
2,530 yards pickets woven into woven-wire fences, 2 feet apart.
400 yards woven wire, 18 feet apart.
1 pair 6-foot wood-frame woven-wire gates (lawn).
3 14-foot woven-wire gates with fixtures.
1 4-foot woven-wire gate with fixtures.
9 hand-made gates with automatic fasteners.
1 thermometer-screen.
1 thermometer (maximum).
1 „ (minimum).
1 „ (maximum and minimum).

APPENDIX No. 17—*Concluded.*

STOCK AND EQUIPMENT, 105-MILE DRY-FARMING STATION—*Concluded.*

1 hygrometer with glass and measuring-glass.
1 rain-gauge.

Furniture—
1 cook-stove.
1 heater.
1 iron bed with springs and mattress.
2 camp-beds.

APPENDIX No. 18.

TOTAL CORRESPONDENCE RECEIVED AND DISPATCHED BY THE DEPARTMENT OF AGRICULTURE FOR THE YEARS ENDING DECEMBER 31ST, 1917 AND 1918.

	Received.		Dispatched.	
	1918.	1917.	1918.	1917.
Office of Deputy Minister—				
General	5,408	4,434	6,302	7,781
Farmers' Institutes	1,582	1,829	1,451	1,606
Women's Institutes	992	1,397	920	1,140
Agricultural Associations	408	744	534	818
Statistics Branch	....	....	....	....
Advisory Board of Women's Institutes	....	....	....	....
Horticultural Branch—				
British Columbia Fruit-growers' Association	....	694	....	731
Horticulture	1,955	1,604	1,976	1,603
Inspection of Fruit Branch	613	660	733	862
Live Stock Branch—				
General	5,659	4,548	5,509	4,788
Soil and Crop Division	2,053	1,869	2,197	2,562
Dairy	1,000	923	1,300	1,303
Silo and Publications Branch	1,005	1,292	768	536
Poultry Division	2,333	1,436	2,804	1,222
Total	23,008	21,430	24,494	24,952

APPENDIX No. 19.

SUMMARY OF APPROPRIATIONS, DEPARTMENT OF AGRICULTURE.

	1916-17.	1917-18.	1918-19.
General—			
Salaries of staff officials	$73,496 00	$65,752 00	$78,184 00
Administration, General Department vote, travelling expenses of officers on duty, and miscellaneous	45,000 00	38,000 00	70,000 00
Agricultural Associations—			
Agricultural Associations, including grants in aid of prize-lists, specific grants for buildings, and judges' expenses	30,000 00	20,000 00	16,000 00
Exhibition—			
Exhibition and publicity work	*Nil.*	*Nil.*	500 00
Institutes—			
Farmers' and Women's Institutes	27,500 00	2,500 00	16 000 00
Horticulture—			
Board of Horticulture, experimental orchards, demonstration spraying, precooling and cold storage, and British Columbia Fruit-growers' Association	9,750 00	34,250 00	* 3,750 00
Inspection of fruit, fumigation of nursery stock, etc.	35,000 00		9,500 00
Fruit-packing schools	1,500 00		
Live stock—			
Various associations	7,750 00	27,500 00	5,750 00
Compensation for cattle slaughtered	12,000 00		20,000 00
Suppression of noxious weeds	10,000 00		
Totals	$251,996 00	$208,002 00	$219,684 00

APPENDIX No. 20.

EXPENDITURE IN AID OF FARMERS' INSTITUTES, YEARS ENDING DECEMBER 31ST, 1917 AND 1918.

	Year 1917.		Year 1918.	
	Total.	Average Cost for 148 Institutes.	Total.	Average Cost for 153 Institutes.
Membership allowances	$4,022 35	$27 17	$4,356 00	$28 40
Grants to Secretaries	3,493 70	23 60	.....	.....
Competitions—				
Field-crop	830 00	5 61	1,312 24	8 57
Seed production	.....	.....	140 00	0 91
Pure-bred stock supplied	1,539 61	10 40	1,590 08	10 39
Manure-hopper at Prince Rupert	160 00	.....	70 91	.....
Gopher campaign—				
Supplies	122 75	0 83	454 36	2 96
Grants for competitions	.....	.....	80 00	0 52
Grants in aid of fairs	200 00	1 35	200 00	1 35
Postage, printing, and advertising	1,606 15	10 86	894 45	5 84
Expenses of Advisory Board	339 50	2 29	66 90	0 43
Miscellaneous	318 96	2 16	143 16	0 93
Total	$12,633 02	$85 36	$9,308 10	$60 83

APPENDIX No. 21.

EXPENDITURE IN AID OF WOMEN'S INSTITUTES, YEARS ENDING DECEMBER 31ST, 1917 AND 1918.

	Year, 1917.		Year, 1918.	
	Total.	Average Cost for 61 Institutes.	Total.	Average Cost for 62 Institutes.
Grant to Secretaries	$1,475 00	$25 00	*Nil.*	
Membership allowances	1,566 75	26 56	$1,276 50	$20 59
Lecturers' expenses	1,349 03	22 86	426 70	6 88
Advisory Board—				
(*a.*) Secretary's salary and expenses	480 00	8 14	665 55	10 73
(*b.*) Expenses of members	1,055 86	17 90	630 07	10 16
Flower-shows—				
(*a.*) Grants	483 00	8 18	337 75	5 44
(*b.*) Prizes	233 12	3 95	130 76	2 10
Conferences	341 60	5 79	508 15	8 20
Printing, advertising, etc.	1,257 94	21 32	490 35	7 90
Purchase of motion-picture films	.....	.....	251 76	4 06
Miscellaneous, including postage, etc.	499 73	8 47	109 16	1 76
Total	$8,742 03	$148 17	$4,826 75	$77 85

APPENDIX No. 22.

GRANTS TO AGRICULTURAL ASSOCIATIONS HOLDING FAIRS, YEAR ENDING DECEMBER 31ST, 1918.

Agassiz Agricultural and Horticultural Association	$ 250 00
Aldergrove Agricultural Association	100 00
Armstrong Spallumcheen Agricultural Society	1,000 00
Arrow Lakes Agricultural and Industrial Association	250 00
Bella Coola Fair and Agricultural Association	100 00
Burquitlam Agricultural Association	150 00
Cariboo Agricultural and Horticultural Association	250 00
Central Park Agricultural Association and Farmers' Institute	150 00
Chilliwack Agricultural Association	600 00
Comox Agricultural and Industrial Association	300 00
Coquitlam Agricultural Society	150 00
Cowichan Agricultural Association	750 00
Cranbrook Agricultural Society	750 00
Creston Valley Agricultural Association	250 00
Elk Valley and Natal Agricultural Association	100 00
Fruitvale Agricultural Association	100 00
Islands Agricultural and Fruit-growers' Association	250 00
Kamloops District Stock-breeders' Association	400 00
Kelowna Agricultural and Horticultural Association	600 00
Ladysmith Agricultural Society	300 00
Langley Agricultural Association	200 00
Lasqueti Island Agricultural Association	100 00
Maple Ridge Agricultural Association	200 00
Matsqui Agricultural and Horticultural Association	200 00
Mission Agricultural Association	200 00
Nanaimo Agricultural and Horticultural Association	350 00
Carried forward	$ 8,050 00

APPENDIX No. 22—*Concluded.*

Grants to Agricultural Associations holding Fairs—*Concluded.*

Brought forward	$ 8,050 00
Nanoose Agricultural Association	100 00
Nelson Agricultural and Industrial Association	500 00
North and South Saanich Agricultural Society	400 00
Northern British Columbia Agricultural and Industrial Association	500 00
Slocan Lake Agricultural Association	150 00
Summerland Agricultural Association	350 00
District of Surrey	250 00
Trail Fruit Fair Association	250 00
Windermere District Agricultural Society	300 00
Total	$10,850 00
Total, year 1917	$12,850 00

APPENDIX No. 23.

British Columbia Show Groups, Year 1918.

District No. 1.—Vancouver Island, from Duncan north and including Duncan, Comox, Parksville, and Nanaimo.

District No. 2.—Vancouver Island, from Duncan south and including Victoria, Saltspring Island, Sooke, Langford, and Cobble Hill.

District No. 3.—Includes the territory west of the eastern boundary of Burnaby; includes North Vancouver, Central Park, and Point Grey.

District No. 3a.—Provincial Show.

District No. 4.—From North Bend south and west to the eastern boundary of Burnaby, including Maple Ridge, Mission, and Chilliwack.

District No. 5.—From North Bend north and east to Sicamous Junction, including Ashcroft, Kamloops, and Salmon Arm.

District No. 6.—From Sicamous Junction south through the Okanagan Valley to Vernon, including North Okanagan.

District No. 6a.—Kelowna, south to International Boundary, including Kelowna, Summerland, and Penticton.

District No. 7.—From Sicamous Junction east to Alberta on the main line of the C.P.R. and south from Revelstoke to Slocan, including Revelstoke, Golden, Arrowhead, and Nakusp.

District No. 8.—From Kootenay Lake west to Okanagan Valley, excepting that part included in District 7, including Nelson, Trail, Grand Forks, and Greenwood.

District No. 9.—Crowsnest Valley, from Kootenay Lake east to Alberta, south of the main line of the C.P.R., including Fernie and Cranbrook.

APPENDIX No. 24.

SUMMARY OF RESULTS, SEVENTH INTERNATIONAL EGG-LAYING CONTEST, VICTORIA, B.C.

Duration of contest (months)	11
Number of pens	40
Number of birds	239
Number of eggs laid	36,996
Value of eggs laid	$1,541.50
Average monthly revenue	$140.13
Average monthly feed cost	$68.70
Cost of feeding	$755.70
Profit over cost of feeding	$785.80
Average price of eggs per dozen	.50
Highest price received per dozen (November 22nd)	.70
Lowest price received per dozen (March 30th)	.40
Average cost to produce dozen eggs	.24.5
Average number of eggs laid per pen	924.9
Average number of eggs laid per bird	154.7
Average cost of feed per pen (six birds)	$18.89
Average cost of feed per bird	$3.16
Profit over cost of feed per pen	$19.64
Profit over cost of feed per bird	$3.28
Eggs laid by winning pen, Class 1	1,077
Average per bird winning pen, Class 1	179.5
Eggs laid by winning pen, Class 2	1,070
Average per bird winning pen, Class 2	178.3

COMPARISON BETWEEN FIFTH CONTEST (11 MONTHS), 1915-16, AND SEVENTH (11 MONTHS), 1917-18.

	Fifth Contest.	Seventh Contest.
Number of eggs laid	36,382	36,996
Cost of feed	$436.45	$755.70
Profit over cost of feed	$594.43	$785.80
Average price of eggs	.34	.50
Cost to produce dozen eggs	.14.3	.24.5
Number of fowls to contest	240	239

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

PROVINCE OF BRITISH COLUMBIA

REPORT

OF THE

COMMISSIONER OF FISHERIES

FOR THE YEAR ENDING DECEMBER 31ST, 1918

WITH APPENDICES

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1919.

To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

I beg to submit herewith a report reviewing the operations of the Provincial Fisheries Department for the year ending December 31st, 1918, with Appendices.

WILLIAM SLOAN,

Commissioner of Fisheries.

Provincial Fisheries Department,

Commissioner of Fisheries' Office,

Victoria, British Columbia, March 4th, 1919.

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FISHERIES COMMISSIONER'S REPORT FOR 1918.

Value of Canadian Fisheries and Standing of Provinces.

The value of the fishery products of Canada for the year ending December 31st, 1917, totalled $52,312,044, as against $39,208,378 for the preceding year, notwithstanding that the latter was considerably greater than in any preceding year.*

During the year 1917 British Columbia contributed fishery products of a total value of $21,518,595, or 41 per cent. of the total for the Dominion.

As in recent years, British Columbia again leads all the Provinces of Canada in the value of her fishery products. Her output for the year exceeded in value those of Nova Scotia by $7,050,276, and exceeded that of all the other Provinces combined by $11,156,941.

The following statement gives in their order of rank the value of the fishery products of the Provinces for the year ending December 31st, 1917:—

British Columbia	$21,518,595 00
Nova Scotia	14,468,319 00
New Brunswick	6,143,088 00
Quebec	3,414,378 00
Ontario	2,866,419 00
Prince Edward Island	1,786,310 00
Manitoba	1,543,288 00
Saskatchewan	320,238 00
Alberta	184,009 00
Yukon	67,400 00
Total	$52,312,044 00

The Species and Value of Fish caught in British Columbia.

The total value of each species of fish taken in British Columbia for year ending December 31st, 1917, is given in the following statement:—

Salmon	$16,828,783 00
Black cod	879,404 00
Hake and husk	1,090 00
Herring	1,192,654 00
Shad	675 00
Halibut	1,721,012 00
Soles	78,649 00
Flounders	23,601 00
Skate	10,117 00
Smelts	14,270 00
Oolachans	10,991 00
Brill	51,420 00
Octopus	1,656 00
Rock-cod	8,688 00
Pilchards	11,810 00
Whiting	2,725 00
Grayfish	4,480 00
Oysters	32,202 00
Clams and quahaugs	84,000 00
Dulse, crabs, and cockles	48,424 00
Trout	10,350 00
Sturgeon	9,790 00
Perch	4,920 00
Carried forward	$21,031,711 00

* The data used here is derived from the Dominion Bureau of Statistics, 1917.

THE SPECIES AND VALUE OF FISH CAUGHT IN BRITISH COLUMBIA—*Concluded.*

Brought forward	$21,031,711 00
Mixed fish	13,184 00
Salmon-roe	7,820 00
Fur-seal skins	6,540 00
Bone-meal	10,185 00
Fertilizer	70,164 00
Whale-oil	342,247 00
Fish-oil	23,892 00
Witches	50 00
Gill-bone	12,802 00
Total	$21,518,595 00

The total value for the year shows an increase over the previous year of $6,881,249; salmon products were increased by $6,285,178, due both to an increase in size of pack and its value. The halibut-catch was less, and, notwithstanding an increase in price, shows a decrease from the previous year of $305,658. The herring-catch is valued at $1,192,654, a slight gain over the previous year, and whale products show a gain of $94,220, with a total value of $446,486.

THE NUMBER OF PERSONS ENGAGED AND VALUE OF FISHERY PLANTS AND APPARATUS IN BRITISH COLUMBIA IN 1918.

The following statement gives the number and the value of the plants, vessels, boats, and apparatus used in the fisheries of the Province in 1918, and the number of persons engaged:—

	No.	Value.
Vessels, tugs, and carrying smacks	514	$ 2,500,801 00
Gasolene-boats	3,172	
Sail and row boats	3,548	1,837,820 00
Value of seines, trap and smelt nets	....	1,829,115 00
Value of hand-lines, weirs, trawls, etc.	....	119,381 00
Approximate value of salmon and other canneries, fish-houses, freezers, and fixtures	....	9,519,941 00
Total		$15,807,058 00

Number of Persons engaged in Fishery.

Number in vessels	1,589
Number in boats	11,378
Number in canneries, fish-houses, etc.	7,916
Total	20,883

THE SALMON-CATCH OF 1918.

The salmon-catch of the year 1918 exceeded all previous records and produced a pack of 1,616,157 cases. It exceeded the previous high record of 1917 by 581,672 cases. The catch of sockeye gave a pack of 276,459 cases, as against 330,209 cases in 1917; 107,354 cases of red and white springs packed, as against 76,276 cases in 1917; the pack of pink salmon totalled 527,745 cases, a gain over 1917 of 30,986 cases; and the pack of 497,615 cases of chum salmon exceeded that of the previous year by 21,342 cases.

THE 1918 SALMON-PACK BY DISTRICTS.

The Fraser River.—The total pack of all grades of salmon on the Fraser River run in British Columbia waters totalled but 210,851 cases, as against 402,538 cases in 1917, 127,472 in 1916, 320,519 in 1915, and 349,294 cases in 1914. Over 50 per cent. of the total pack consisted of chums and pinks. The catch of sockeye was less than 10 per cent. of the total, was much less than in any former year, and produced a pack of but 19,697 cases, as against 198,183 cases in the previous fourth year, 1914. Since 1914 was the brood-year of the greater proportion of this year's sockeye run, it shows that the run was less than 10 per cent. of that of its brood-year.

The season's pack of Fraser River seeking sockeye on Puget Sound totalled 50,723 cases, as against 357,374 cases four years ago. The pack of sockeye in the entire Fraser River District in 1918 totalled only 70,420 cases. Four years ago the combined catch of sockeye in that district produced a pack of 534,434 cases, or 86 per cent. more than this season. A more forceful demonstration of the depletion of the run of sockeye to that river could not be exacted. It warrants the statement that the Fraser is fished out of sockeye and the run is perilously near extinction. The conditions that have produced this result have been set forth in previous reports of the Department. As early as 1902 the Department gave warning that too many sockeye were being taken, and that, unless the fish were permitted to reach the spawning-grounds in far greater numbers, the run would be exterminated. Year after year that warning was repeated, and backed up by statements showing a steady decline in the number of sockeye that reached the spawning area. The warning fell upon ground as barren as the spawning area. The fishermen and the canners would not be denied. The amount and efficiency of the fishing-gear used to take the fish was increased without giving the sockeye any additional protection. The Canadian authorities indicated in no uncertain manner their willingness to meet the conditions by restricting fishing in their waters. The authorities of the State of Washington could not be induced to meet the situation by affording the fish that pass through their waters to reach the Fraser any adequate measure of protection. They disputed the facts submitted, and instead of restricting fishing they permitted an increase in the amount and character of gear used, thus adding to the efficiency of their methods. Even as late as the spring of 1918, at the American-Canadian Fisheries Conference, the State of Washington authorities contended that conditions on the Fraser were not of so serious a nature as to call for drastic treatment. At the Vancouver meeting of that Conference the Commissioner and his assistant both submitted written statements setting forth the views of the Provincial Government on this vital question. Those statements are reproduced in the Appendices of this report.

The Salmon-catch of Northern Waters.

The Skeena River.—The salmon-pack on the Skeena River in 1918 exceeded all previous records with a total of 374,216 cases, as against the previous record pack of 292,219 cases in 1917. There was a gain in all grades. Sockeye gave a pack of 123,322 cases, as against 65,760 in 1917, 60,293 cases in 1916, 116,533 in 1915, 136,166 in 1914, and 52,927 in 1913. Weather conditions throughout the sockeye season were most propitious. Fishing for spring and cohoe salmon was conducted at numerous outlying points by trollers, many of whom had excellent season's return.

Rivers Inlet.—The catch of salmon on the Rivers Inlet section shows a substantial gain over the two preceding years, with a total pack of 103,155 cases. The catch of sockeye gave a pack of 53,401 cases, as against 61,195 in 1917, 44,936 in 1916, 103,350 in 1915, 89,890 in 1914, and 61,745 in 1913. The pack of pinks exceeded all previous years, with a total of 29,542 cases, as against the two previous high records of 8,065 in 1917 and 5,784 in 1914. The run of pinks to Rivers Inlet has heretofore been very small. No theory as to the increase of this season has been advanced.

The Nass River.—The catch of salmon in the Nass River section is also a high-record one, totalling 143,908 cases, as against the previous high records of 119,495 in 1917 and 126,686 in 1916. The catch of sockeye again shows a decline, with a pack of 21,816 cases, as against 22,188 in 1917, 31,411 in 1916, 39,349 in 1915, and 31,327 cases in 1914. The record shows a steady decline in the run of sockeye notwithstanding the increase of gear used. The catch of pinks and chums shows substantial increase and is attributed to the more extensive use of traps and gear.

The Vancouver Island Section.

The pack of salmon taken from Vancouver Island waters, with the exception of the sockeye taken in the trap in the vicinity of Sooke, that are credited to the Fraser pack, totalled 389,815 cases. Operations were conducted at all points where any salmon could be taken. Large numbers of spring and cohoe salmon were taken in the open sea, facing the west coast, by means of trolling. Some 400 small boats were so engaged. The catch of sockeye was small. All other grades show an increase. Chums, with pack of 251,266 cases, exceed all others combined. The catch of pinks gave a pack of 57,035 cases and cohoe 40,732 cases. Some 5,500,000 lb. of salmon, mostly

chums, was exported in fresh state from the west coast. The catches made are regarded by the Department as an overdraft on the runs, and if continued will exterminate them.

The Catch at Nitinat Lake.

The catch of fall-running salmon at Nitinat Lake, on the southern shore of Vancouver Island, in both 1917 and 1918 were of such an extraordinary and excessive nature as to call for extended comment. Nitinat Lake is but fourteen miles in length by half a mile in width. It lies at sea-level and is connected with the sea by a narrow and short passage. There is but one tributary of importance, the river at the head of the lake, which has a length of some twenty miles. Except during heavy rains, its volume is not large. Its gravelled channel offers a limited extent of spawning area. It is the only tributary frequented by salmon. A few creek sockeye are said to enter it in the late spring. Chums in large number run to that stream in the fall. Commercial fishing was first undertaken there in 1917 by the Lummi Bay Packing Company, who built a cannery there that spring. By the use of two purse-seines the company's catch in 1917 produced a pack of 51,252 of chum salmon. Not being able to handle all the fish taken, they exported to their plants in the State of Washington some millions of pounds. Their pack in 1917 was the second largest put up at any one cannery in the Province. In 1918 the catch at Nitinat Lake produced a pack of 84,000 cases, 20,000 cases more than were packed at any other one cannery in the Province. The fishing-gear used by the company consisted of two purse-nets and a trap, driven at the mouth of the river at the head of the lake. In addition to the pack of 84,000 cases, some 5,000,000 lb. of salmon were exported from that district. No other water of anything like the proportions of Nitinat Lake has ever produced in two succeeding years anything like as many fish. No salmon run to any watershed of its size can stand such a drain without complete annihilation.

The drain on the salmon run to all Vancouver Island waters is in the judgment of the Department excessive, and calls for the immediate and serious attention of the fishery officials of the Dominion. The fish must be given far greater measures of protection than at present afforded them, or they will cease to be of commercial importance.

REPORTS FROM SALMON SPAWNING AREAS OF THE PROVINCE IN 1918.

During the season the Department, as usual, conducted an investigation of the salmon spawning areas of the Fraser River and Rivers and Smith Inlets. Detailed reports are attached hereto.

The spawning-grounds of the Fraser River basin were again inspected by John P. Babcock, Assistant to the Commissioner. He was assisted by Dr. C. H. Gilbert and Inspector of Fisheries C. P. Hickman. In the report made by Mr. Babcock it is again disclosed that the number of salmon which reached the spawning-beds was far less than in any previous year. In all the great lake sections of the Fraser above Hell's Gate Canyon there were few or no sockeye, and in the lower section, with the exception of the Lillooet Lake District, there were fewer sockeye than ever previously reported. As affecting future runs no importance need be attached to the few that did spawn in the upper section of the Fraser, and less importance than heretofore can be attached to those that spawned in the lower section. The total number of sockeye-eggs collected from the tributaries of the Fraser and placed in the hatcheries totalled 20,581,500, as against 22,484,000 four years ago. Twenty million sockeye-eggs were taken from Alaska waters by the United States Bureau of Fisheries and donated to the Dominion Government to assist in restocking the Fraser, and were shipped to the hatchery on Harrison Lake and are being incubated therein.

Rivers and Smith Inlets Spawning-grounds.—Fishery Overseer A. W. Stone reports that there was a serious shortage of sockeye salmon on the spawning-beds of Owikeno Lake, at the head of Rivers Inlet. He estimates that there was 25 per cent. less sockeye on the beds than in any one of the past six years.

Officer Stone, who also inspected the spawning-grounds of the Smith Inlet run of sockeye, reports that the number of fish observed there this year equalled the run of 1915, but that they were many times less than in 1914.

THE AMERICAN-CANADIAN FISHERIES COMMISSION OF 1918.

The American-Canadian Fisheries Commission appointed by the Governments of the United States and Canada to investigate fishery questions in waters contiguous to their boundary-lines

held meetings on this Coast, in Seattle, Vancouver, Prince Rupert, and Ketchikan in the spring of 1918. The Commission consisted of the Secretary of Commerce and Labour of the United States, the Hon. William C. Redfield, E. F. Sweet, Assistant to the Secretary of Commerce, and Dr. Hugh M. Smith, United States Commissioner of Fisheries, on behalf of the United States; and the Hon. Chief Justice J. D. Hazen, of New Brunswick, G. J. Desbarats, Deputy Minister of Naval Service, and Wm. A. Found, Superintendent of Fisheries, Ottawa, on behalf of the Canadian Government. The inquiry conducted on this Coast was confined to an investigation of the salmon-fisheries of the Fraser River and the American waters of Washington Sound and the halibut-fisheries of the Pacific.

At the Vancouver meeting of the International Commission, Commissioner Wm. Sloan and his Assistant, John P. Babcock, made extended statements as to conditions in the Fraser, which are reproduced in the Appendix of this report.

The Conference concluded its sittings in Ottawa in September and unanimously adopted a report. At the time of writing the report has not been made public.

Fishing by Indians in the Fraser River Basin above Tidal Limits.

The runs of salmon to the spawning-beds of the Fraser have become so alarmingly attenuated that drastic measures will have to be taken to restore the runs. The measures to be taken must not only include the secession of all fishing in tidal limits for a period of years, but must be made to include all fishing above tidal limits by Indians for all time, notwithstanding that they have both a natural and a treaty right to take such salmon as they desire for food so long as they confine themselves to the gear originally used by them.

The Indians resident in the Fraser River basin have always fished for salmon. Before the advent of the white men they depended almost wholly upon salmon for their winter food. They take them as near their homes as possible and cure them by smoking. An approximate estimate of the number of sockeye salmon taken by Indians above the commercial fishing limits on the Fraser River in the years of the big runs previous to 1913 place the number at 200,000. It probably largely exceeded that number. The number taken in former years of the big run by the Indians resident in the Chilcotin River section is placed at from 40,000 to 50,000. Those taken by Indians from the Fraser basin above the mouth of the Chilcotin is given at 20,000, and between the mouth of the Chilcotin and Bridge Rivers at 40,000-odd, while those along the banks of the Thompson and Shuswap and Adams Lakes at 30,000, in the canyon of the Fraser at Yale at 15,000, and in the Harrison-Lillooet Lakes section at 40,000. The figures here given include only sockeye that were taken, dressed, and cured. They do not include the other species of salmon taken or the sockeye consumed in a fresh state. The catches made by Indians in the years of the big runs previous to 1913 were not a serious drain on the run of those years. The numbers taken during the lean years, though considerably less than in the big years, was a serious drain on the spawning-beds. During the last decade none of the tribes above the canyon at Yale have been able to get any considerable number in any lean year, and their catches in both 1913 and 1917 did not exceed those of early lean years. The drain on the runs was nevertheless serious.

The right of the Indians to take salmon is unquestioned, but the number of salmon they can now catch is so small as to be of little benefit to them. Owing to the fact that most of the Indians now grow the bulk of the food they use and are no longer dependent upon salmon, and that drastic measures must be taken to restore the runs of salmon to the Fraser, the Government should step in and acquire by purchase the Indians' right to take fish above the commercial boundaries. It is suggested that the Indians, if deliberately approached, would dispose of their fishing rights to the Government, and that the Government is fully warranted in entering upon negotiations to acquire those rights. The sooner the better.

It is self-evident that salmon taken from the vicinity of their spawning-grounds are much more valuable individually and collectively than the fish taken within commercial fishing waters. Sockeye that were worth 75 cents each to commercial fishermen on the Fraser the past year are worth many times that amount on the spawning-grounds. The runs of the future depend upon the number of eggs deposited and hatched within the river's basin. The female sockeye of the Fraser produce averagely 2,500 eggs each.

It has been suggested that the Indians be deprived of their right to fish above commercial fishing boundaries, and in lieu thereof be aided to do all their fishing within commercial limits.

Possibly the Indians in the delta of the Fraser and those resident south and west of Yale might operate to advantage and fairly economically. The suggestion is wholly impracticable so far as the great majority of the Indians are concerned. Very few of the Indians from the Chilcotin or north of Bridge River have ever engaged in fishing within commercial waters. For them to journey, with women, who do all of the work of dressing and smoking the fish, from their homes to tidal waters and then back again with their bales of dried fish would cost the Government many times more than to purchase and transport a far greater supply of other foods for the use of the Indians at home.

The Indians of the Fraser are reasonable beings. There are many clear-headed men in their councils. If this matter be taken up with them in a deliberate, clear, and painstaking manner, it is advanced that they would soon see the benefits to be derived by disposing of their fishing rights. Their right at the present time is of little value to the most of them and is steadily lessening in value. Many of them realize this to be true. The Government should act in this matter without further delay; the expense to be covered from the collection made for fishing licences.

Migration of Adult Sockeye Salmon in Puget Sound and Fraser River.

During the American-Canadian Fisheries Conference on the Pacific Coast in April and May, 1918, questions were raised as to the time taken by sockeye salmon to pass from the waters of Juan de Fuca Strait through Puget Sound and the Gulf of Georgia to the Fraser River. In order to settle this important economic question, experiments were made by the Fishery Departments of Canada and the United States Governments in marking with metal tags adult sockeye taken from fish-traps in the waters named. The results of this experiment are covered in a report just issued by the Bureau of Fisheries, Washington, D.C., which is reproduced in the Appendix of this report from advance sheets furnished the Department by Dr. Hugh M. Smith, United States Commissioner of Fisheries. The report is of interest, though it cannot be said that the results of the experiment have by any means determined the questions at issue. The questions involved are vital in determining measures of conservation, and must be conducted for a sufficient period of years to produce conclusions of value.

Contribution to the Life-history of the Sockeye Salmon.

Dr. Gilbert's fifth contribution to the reports of the Department on the life-history of the sockeye salmon, which is issued herewith, includes an analysis of the sockeye runs of 1918 to the Fraser, Skeena, and Nass Rivers and Rivers Inlet, and throws much additional light on the mooted question of the return of mature spawning salmon to the particular part of a river's basin in which they had been hatched and reared. The present paper is of great value since it conclusively demonstrates that, in the Fraser at least, the sockeye does return to spawn in the identical tributary in which it was hatched. In dealing with this important economic question Dr. Gilbert considers a number of propositions. If there was, he submits, no tendency for a salmon to return to any definite spawning district, the sockeye entering so extensive a basin as the Fraser would be as likely to spawn above as below the canyon at Yale. Every spawning-bed in that event would contain individuals which had been hatched and reared in widely different portions of the basin, and the output of one centrally located hatchery would furnish stock for all sections, since each spawning area would draw indifferently on the common stock of returning migrants and the salmon frequenting it would necessarily agree in their structural characteristics with those frequenting each of the other spawning areas throughout the basin. There would be no basis for differences. Those spawning in different parts of the basin would agree in their average size as yearlings and as adults. They would agree in the relative number of four- and five-year-old fish, in the relative numbers of those which had spent one year or two years in fresh water after hatching, or had proceeded to sea as soon as they were free-swimming. All the groups and all the variations of character which are found in the main runs off the mouth of the river would be repeated in every spawning section. Such would inevitably be the case if the salmon passed indifferently to the various spawning areas, without reference to that of their native habitat.

On the other hand, he submits that if differences are found to exist in the populations of distinct spawning districts it must be considered direct evidence that segregation has occurred, and is based on some principle which has determined that certain individuals in the common

run shall pass to one spawning area while others go elsewhere to spawn. The only principle adequate to explain such segregation, if it generally occurs, would be the return of fish to spawn in their native tributary.

Dr. Gilbert abundantly demonstrates that the latter principle obtains, as between different river-basins, even when they are very limited in size and have their outlets to the sea in close proximity to each other. In their passage to these minor streams along the salt-water channels the schools of sockeye are often intimately mingled, and they separate only as the river-mouths are approached. Off Namu, on Fitzhugh Sound, gill-nets operated along the shore capture in about equal numbers at the same time sockeye which are bound for Bella Coola and those which are bound for Kimsquit. They have been distinguished by characteristic scale-markings. They run together along the same channels. Where they separate has not been demonstrated, but by the time Bella Coola and Kimsquit Rivers are reached complete separation has occurred. Dr. Gilbert points out that this case does not seemingly differ greatly with that of fish bound for different tributaries of the same river. Conceivably, the schools may be separated as their respective tributaries are reached. If the populations of these tributaries show distinguishing characteristics, no other satisfactory explanation presents itself. It must be considered, he states, also, that a partial segregation of spawners may occur, though not a total one. That within certain limits indifference exists as to the precise spawning-ground frequented. Thus the up-river fish may predominately run early and proceed above the canyon in the Fraser, passing without selection into any stream that becomes available; while the late-running fish may enter the Harrison, the Pitt, and Cultus Lakes again without determinate destination. That this supposition is without validity for the lower river becomes evident from the fact, emphasized in last year's report, that the fish entering Pitt Lake are so widely different from those entering Cultus Lake, and even the different spawning-beds of the Harrison, can usually be shown to possess individual characteristics of unquestioned significance.

With regard to the river above the canyon the case is not so clear, partly due, no doubt, to lack of adequate material. No material at all adequate has been obtained from any up-river tributary except the Chilcotin, because of late years the runs to the upper river have become extremely attenuated. Efforts of the last two years failed to produce the desired evidence, and it may now be too late to secure it owing to permanent depletion.

Where spawning populations show distinguishing characteristics, the inference is clear and unavoidable. A physiological barrier has existed for so long a period that minor differentiations have developed and a strain or sub-race has been formed. But what is to be concluded in cases where the colonies of two distinct spawning areas present no characteristics by which we can distinguish them? Obviously, Dr. Gilbert states, we must infer either (*a*) that segregation in their case has not occurred, or (*b*) that it has occurred but has not been effective in producing divergence between the colonies. If the first of these were true, it would signify that the "home-stream" instinct was in most cases rigidly operative, while in one or more instances within the same river-basin it was wholly in abeyance. The second supposition would seem *a priori* far less improbable. Complete segregation of spawning fish may occur, and each individual return to the stream in which it was hatched and reared, and yet, in certain instances, separate colonies may have failed to develop distinct methods of growth by which they can be distinguished. A failure to discover distinguishing characteristics between populations of separate spawning areas need not indicate that their progeny will fail to return at maturity to its native stream. The two colonies may have been wholly distinct and self-perpetuating for a very long period and yet no differences have been developed. If we should adopt distinctive marks for the young from each of the two streams on their downward migration to the sea, it might be shown at maturity that each stream contained spawners with a single mark only, the one that had been given to the young from that stream. Yet the adults from the two streams might be otherwise indistinguishable. Negative evidence in such a case proves nothing. But if affirmative evidence is found, it is conclusive. If differences are found to exist, there is no alternative to the acceptance of the "home-stream" theory. Reviewing the evidence collected in the Fraser basin in 1918, Dr. Gilbert says:—

"In general, it can be stated that the examination of this material completely supported and verified the conclusions reached in 1916 with regard to the spawning-beds below the canyon; *we affirm without qualification that they are as distinctively populated as though located in separate streams independently entering the sea.* Additional material only emphasizes the fact.

Not only were the different colonies in 1918 marked by distinctive characters, but these characters were the same for each colony as those noted in 1916."

Dr. Gilbert shows that a very conspicuous instance of racial differentiation is furnished by the Harrison watershed. It is not known how many distinct spawning areas may have existed there. Several minor colonies, like that known to have existed at Silver Creek, are now practically exterminated, and there are doubtless distinct areas in Lillooet and Tenas Lakes, but no records have been obtained. A very limited number of late spawners still frequent the slack waters of the main river above Harrison Rapids, the vanishing remnant of a once fine run visits the lake at the head of Morris Creek, and a considerable run still goes up the Birkenhead River; both of these runs pass over the spawning-beds at the Harrison Rapids, but not one of them tarries there. An examination of 200 spawners taken from the rapids in 1918 by Mr. Robertson, the clever Superintendent of the hatchery on Harrison Lake, failed to yield a single fish which had been spawned elsewhere. Not one of the 200 could be confused with those constituting either the Morris Creek or the Birkenhead colony, and not one of the fish taken on the rapids was found among the 400 specimens taken at Morris Creek, and over 200 from the Skookumchuck and the Birkenhead. No Morris Creek strays were found in the Birkenhead and no Birkenhead fish were found in Morris Creek, in spite of the fact that the Birkenhead fish had all passed close to the mouth of Morris Creek on their way up. In these cases the law of segregation is most strictly in force, yet it seems impossible to imagine a locality better suited to straying of the spawning fish with resulting mixture of populations. That it does not occur here gives confidence that the same law rules everywhere, though the evidence of it may be less compelling.

The most interesting colony of the Harrison, Dr. Gilbert shows, is the one which spawns late in the season at Harrison Rapids. The nature of that spawning area is in itself highly unusual. The spawning habits of the sockeye have been shown to be rigidly fixed. Unlike other species, they must resort to a lake, and fail to frequent streams save during their migrations. They spawn in lake tributaries or on the gravel shores of lakes. Their young develop in the waters of lakes and commonly reside there over a year before migrating to the sea. Of the few which descend from lakes to the sea, few ordinarily survive to return at maturity. But the Harrison Rapids spawners use gravel-bars in the main river and there is no lake between them and the sea. Their young, in consequence, have no lake to drop down to. They have, Dr. Gilbert shows, adopted the highly exceptional method of life for a sockeye, of migrating to sea as soon as they are free-swimming and before their scales have begun to grow. No data is obtainable as to the percentage of survival, but enough have survived to keep the colony flourishing. This is apparently not true of the sockeye of any other spawning area of the Fraser. It demonstrates, however, that under the spur of necessity a sockeye colony can adapt itself to the habit of sea migration in the early free-swimming fry stage, a rare habit in sockeye, though a characteristic of pink and chum salmon and frequently of the spring. The 200 specimens of Harrison Rapids spawners taken and examined in 1918 had all gone to sea in the fry stage. Not one of them exhibited in the centre of its scale any trace of growth in fresh water. The scales from all others taken from different spawning areas recorded growth in fresh water of a year or more. In 1918, as in 1916, Dr. Gilbert failed to find any individuals of sea-type spawning in any part of the Fraser basin other than the Harrison Rapids, though upwards of a thousand specimens from other sections were examined. The fact that no sockeye of sea-type was discovered elsewhere in the basin, when coupled with the further fact that every Harrison Rapids sockeye belonged to the sea-type, furnishes the strongest possible evidence of the return of spawning sockeye to their native districts.

Dr. Gilbert's paper is reproduced in the Appendix of this report, together with reproductions of microscopic photographs of the centres of thirty-four scales of sockeye salmon taken from many sections of the Fraser River basin, the markings of which demonstrate that in the Fraser the sockeye returns to spawn in the identical tributary in which it was hatched.

HALIBUT.

The landing of halibut at our ports and those of Seattle and Tacoma for the year 1918 shows a decrease of 14,375,000 lb. from that of 1917. Vancouver landing for 1918 totalled but 1,902,000 lb. as against 5,162,000 lb. in 1917. Prince Rupert shows a decrease of 3,801,000 lb., with total landings of 14,777,000 lb. Such statements demonstrate the alarming decrease of this fishery and afford additional evidence of the value of the publications of this Department in

1915 and 1916 on the condition affecting the fishery, and which furnished evidence to show that the banks had been seriously depleted, and that early action on the part of Canada and the United States must be taken if the fishery was not to be destroyed. Up to this time no action has been taken by either Government. Joint action alone can be effective. This subject was considered by the American-Canadian Conference and evidence taken. The conclusions reached have not been made public. The remarkable and alarming decline in the catch of 1918 is most impressive and demands early action upon the part of Canada and the United States. The correctness of W. F. Thompson's conclusions, furnished and published by this Department in 1915 and 1916, can no longer be questioned. Unless the halibut is given immediate and radical measure of protection, they will be exterminated on this Coast as they have been on the Atlantic. International action must be taken. By no other means can the halibut banks be given the necessary protection.

WHALING.

Whaling during 1918 was most successful. Three stations were operated on our Coast. The following statement, furnished the Department by the Consolidated Whaling Company, of Victoria, gives the number and species of whales landed at each of their stations during 1918:—

Statement showing Number and Species of Whales landed at British Columbia Stations in 1918.

Station.	Sperm.	Sulphur.	Fin.	Sei.	Hump.	Right.	Bottle-nose.	Total.
Kyuquot	12	4	88	101	41	..	..	246
Rose Harbour	17	12	69	15	25	1	1	140
Naden	5	15	51	14	29	..	..	114
Totals	34	31	208	130	95	1	1	500

CANNED WHALE-MEAT.

A total of 29,585 cases of whale-meat was canned at the company's station of Kyuquot in 1918. The pack was made in round 1-lb. flat tins similar in all respects to salmon, each case containing forty-eight tins. The Commissioner's Assistant made a careful inspection of canning operations, and in his report said: "The canning plant at the Kyuquot whaling-station, where the meat of the whale is canned, is up to date in every respect. I followed the process through every detail. Every feature of it, from the cooling of the meat to the sealing of the can, is in every respect all the most fastidious could wish. I sampled the contents of many cans taken from the pile of those canned previous to my visit. The contents, to my taste, equalled the best canned beef or mutton in the market. There can be no question but that canned whale-meat will command a market." A rapid expansion in output is anticipated.

PILCHARDS.

The run of pilchards to the estuaries of the west coast of Vancouver Island was greater than previously reported. Heretofore they have not been noted on the west coast in waters south of Barkley Sound. This year they were taken in numbers by the salmon-traps in Juan de Fuca Strait and in nets in Esquimalt Harbour, Cadboro Bay and Haro Strait as far north as Mayne Island. The fish were large and fat. Many were sold fresh and several salmon-canners packed them in 1-lb. and ½-lb. cans, and they met with ready sale.

DEEP-SEA TRAWLING.

The distinguishing feature of the fishery year was the successful operating of deep-sea trawling vessels from our ports. Experiments conducted in 1917 out of Prince Rupert demonstrated that there were "banks" adjacent to that port where trawling could be conducted, and which resulted in the successful operations of 1918. The trawler "James Carruthers" made forty-nine trips out of Prince Rupert between February 28th and December 19th, occupying 151 days, which resulted in the landing of some 2,000,000 lb. of fish consisting of flounders, sole, witch, brill, cod, skate, and a limited amount of halibut. The average trip of the trawler from dock to dock was three days. On being dressed the fish were placed in cold storage and frozen, and marketed principally in the North-west, under provisions of Order No. 18 of the Canada Food Board, being

retailed from 10 to 11 cents per pound; the Dominion Fisheries Department assuming two-thirds of transport charges. The trawlers' operations were limited because of the lack of a market. The catch was in excess of the demand. There is no longer a question as to lack of supply or suitable trawling "banks." Given a market an abundant supply is assured.

The bulk of the catch was, as stated, marketed in the North-west. Heretofore that section has been supplied only from the Coast with salmon and halibut. Other salt-water fishes were unknown. The sale of Pacific flatfish and cods was stimulated by an active publicity campaign conducted by the Canada Food Board. Sales in 1918 were sufficiently large to warrant the belief that a permanent market can be established, provided the price of that year can be maintained. There is no question as to the food values of trawl-caught fish. They are the equal of any food-fishes, with the exception of salmon. They have more flavour than halibut, and can be sold at less than half the price of either salmon or halibut. Evidence of the value in which they are estimated is demonstrated by the fact that the landing of trawl-caught fish at the chief ports of Great Britain, notwithstanding the war, between May 4th and September 14th, 1918, totalled 1,658,764,000 lb. During the last four months of 1917 an average of 1,500,000 lb. per month of trawl-caught fish were landed in San Francisco.

In face of the declining catch of our estuary and halibut fisheries, it is encouraging to record the success of deep-sea trawling from our ports. A success so great as to warrant the belief that eventually a large fleet of trawlers will operate from our ports.

The Department give considerable attention to the operation of the trawlers. Curtailed as operations were by a limited market and cold-storage capacity, they were extensive enough, as stated, to warrant exploitation. In advancing measures for the engagement of returned overseas service men, the Commissioner stated:—

"In formulating measures for the engagement of returned overseas men, full consideration should be given to the fisheries. Deep-sea trawling conducted out of British Columbia ports in 1917 and 1918 were profitable and afford evidence of the wealth of food-fishes that await exploitation. What is required at this time to reap the wealth is more suitable vessels and more trained men to operate them. This want can be supplied on the Pacific Coast by the establishment of a trawling-school—a school for the training of men to engage in deep-sea trawling-fishing—by providing a number of suitable vessels equipped for deep-sea fishing and officered by experienced navigators, engineers, and fishermen to act as instructors, and to which returned overseas men could be apprenticed for instruction in navigation; the assembling and operation of steam and gas engines; the construction, care, casting, and hauling of trawl-nets; and the dressing, storing, packing, and shipment of the fish caught.

"In consequence, it is suggested that the Government provide a number of suitably equipped vessels, man them with capable instructors, and engage them in training returned overseas men in deep-sea trawling-fishing. The men during their apprenticeship to be paid a good living wage and given a bonus from the ship's earnings, after capital expenditures have been paid, that would eventually give the apprentices, who by that time are experienced men, the ownership of the vessel.

"Well managed, the operations of such vessels would be sufficiently profitable to furnish the means for operation and maintenance and create a sinking fund that would reimburse the Government and permit the vessel being transferred to the men to be worked on their own. There is room for at least ten such training-ships on the Pacific Coast of Canada, each of which could provide tuition for twenty-five apprentices. Such a school as is here suggested could be directed and operated in connection with the Naval Training School now established at Esquimalt.

"In addition to the practical trawling sea school here suggested, there should be established at Prince Rupert and Vancouver fish curing and packing schools for the practical training of overseas men in the curing, packing, and marketing of fish, and through which the catches of the training-trawlers could market their catch.

"Men graduated from the land school could be sent in to the North-west and established as wholesale and retail handlers of both frozen and cured fish, first as the agents of the schools, and so bonused as to eventually acquire their plant and the business they have been enabled to establish.

"The establishing and maintenance of such schools as are here suggested will not provide for the engagement of a large number of returned men, but it does provide for a number and will materially assist in building up a food-providing class of hardy men in a field where men are needed and where they may gainfully engage."

THE OTTESEN METHOD OF FREEZING FISH.

A. Ottesen, an exporter of fish of Thistal, Denmark, after years of experience, has invented a system of freezing fresh fish that has widely been adopted in Europe, and which should prove of value to companies operating in the Province which are not equipped with cold-storage plants.

The Fishery Director of Norway described the Ottesen method as revolutionizing the fish-refrigerator. The Inspector-General of France says: "After being thawed in water for five or six hours the fish frozen by the Ottesen method look like fresh fish and are in the same condition. The freezing does not cause the slightest injury to the flesh tissues, but, on the contrary, after the fish have been prepared for the table they keep their firmness and full flavour. Fish so frozen have been shipped long distances without change in texture or flavour."

The principle of the Ottesen method is simple and easily understood. The fish are not frozen in the ordinary way in air, but in a strong solution of common salt in water, which is cooled to very low temperature and in which the fish are immersed. The freezing-point of the solution of salt depends upon the degree of saltness; the more salt, the lower the temperature. A solution with 3 per cent. of salt freezes the fish at about 27° Fahr. A solution with 17 to 20 per cent. of salt may be cooled down to from 10° to 60° Fahr. without freezing the solution. It is a solution of this kind which is used (instead of cooled air) to remove the heat from the fish and to freeze it. The apparatus consists essentially of an insulated iron vat or container of suitable dimensions in which the salt solution is placed. The cooling of the solution is accomplished by means of a central spiral, or worm, of iron tubing in connection with an ammonia refrigerating-machine, and the solution is kept in constant movement by a central revolving propeller. Large fish are hung in the solution, the smaller being placed in baskets of wire netting.

The great value of the method appears in the simplicity of the apparatus, its cost, and in the rapid freezing of the fish. Herring in baskets are completely frozen in half an hour and the largest cod in from two to three hours. In ordinary methods of freezing in air the time taken would be from twenty-four to thirty hours. An ordinary Ottesen apparatus can freeze 10 tons of fish in twenty-four hours.

The A. Ottesen fish-freezing process was patented in Canada several years ago and the Canadian rights sold to the Det Danske Frysnings Kompagin, address 33 Ny Toldbodgade, Copenhagen.

THE SOCKEYE SALMON-PACK* OF THE FRASER RIVER DISTRICT FROM 1900 TO 1918, INCLUSIVE.

Year.	Fraser River.	Puget Sound.	Totals.
1900	229,800	228,704	458,504
1901	928,669	1,105,096	2,033,765
1902	293,477	339,556	633,033
1903	204,809	167,211	372,020
1904	72,688	123,419	196,107
1905	837,489	847,122	1,684,611
1906	183,007	182,241	365,248
1907	62,617	96,974	159,591
1908	74,574	155,218	229,792
1909	585,435	1,005,120	1,590,555
1910	150,432	234,437	384,869
1911	62,817	126,950	189,767
1912	123,879	183,896	307,775
1913	736,661	1,664,827	2,401,488
1914	198,183	336,251	534,434
1915	91,130	64,584	155,714
1916	27,394	78,476	105,870
1917	148,164	411,538	559,732
1918	19,697	50,723	70,420

* Given in cases—forty-eight 1-lb cans to case.

The following statement of the salmon-eggs placed in the hatcheries of the Province in 1918 is furnished by Lieut.-Colonel F. H. Cunningham, Chief Inspector of Fisheries for the Dominion:—

STATEMENT SHOWING TOTAL NUMBER OF EGGS PLACED IN VARIOUS HATCHERIES, 1918.

Name of Hatchery.	Sockeye.	Spring.	Cohoe.	Humpback.	Eastern Spk. Brook Trout.	Dog Salmon.	Alaska Sockeye.	Whitefish
Anderson Lake, V.I.	2,515,500	.....	272,000	.....	.....	.....	.....	.....
Babine Lake, Skeena River	9,100,000	.....	.....	.....	.....	.....	.....	.....
Cowichan Lake V.I.	.....	465,500	2,172,900	.....	.....	.....	.....	.....
Cultus Lake, Fraser	3,120,000	.....	1,038,000	.....	.....	.....	.....	.....
Gerrard, Kootenay	.....	.....	.....	.....	30,000	.....	.....	.....
Harrison Lake, Fraser	1,873,000	3,025,000	42,000	.....	.....	396,000	20,700,000	7,000,000
Kennedy Lake, V.I.	2,514,875	.....	.....	.....	.....	.....	.....	.....
New Westminster, Fraser	.....	.....	650,000	126,000	.....	.....	.....	.....
Pemberton, Fraser	11,960,000	45,000	.....	.....	.....	.....	.....	.....
Pitt Lake, Fraser	3,628,500	.....	192,000	.....	.....	24,000	.....	.....
Rivers Inlet	3,024,000	.....	.....	.....	.....	.....	.....	.....
Seton Lake, Fras'r	.....	.....	.....	15,363,000	.....	.....	.....	.....
Totals	37,735,875	3,535,500	4,366,900	15,489,000	30,000	420,000	20,700,000	7,000,000

SOCKEYE EGG-TAKE AT FRASER RIVER HATCHERIES FROM 1901 TO 1918.

1901	15,741,000
1902	72,034,000
1903	13,464,000
1904	9,469,000
1905	97,656,000
1906	51,121,000
1907	53,952,000
1908	46,709,000
1909	98,000,000
1910	37,343,000
1911	22,937,000
1912	38,500,000
1913	86,000,000
1914	28,589,000
1915	68,476,000
1916	40,203,000
1917	31,004,000
1918	20,581,500*

* In addition to the collections made from Fraser River, 20,000,000 sockeye-eggs taken in Alaska were hatched at Harrison Lake.

APPENDICES.

THE SPAWNING-BEDS OF THE FRASER RIVER.

Hon. Wm. Sloan,
Commissioner of Fisheries, Victoria, B.C.

Sir,—I have the honour to submit that during the season just closed I made a thorough inspection of the salmon fishing and spawning grounds of the Fraser River. The catch of all species of salmon from the Fraser River District within the Province produced a pack of only 201,851 cases, of which more than half consisted of pinks and chums. The total pack of all grades four years ago totalled 349,294 cases, 198,183 of which were sockeyes.

The Catch of Sockeye.

The catch of sockeye in Provincial waters of the Fraser River District this year was very much the smallest ever made. It produced a pack of only 19,697 cases, as against 148,164 cases in 1917, 32,146 in 1916, 91,130 in 1915, and 198,183 in the preceding fourth year, 1914. The catch in our waters of the district was but 10 per cent. of that made in the latter year, the brood-year of the greater proportion of this year's run.

The catch of sockeye this season in the State of Washington waters, included in the term Fraser River District, was but 14 per cent. of that made in those waters four years ago. The combined catch of sockeye in that entire district this season was the smallest ever recorded, and was 87 per cent. less than the catch in the preceding fourth year.

Since the primary test of the size of a run of sockeye to the Fraser River District is the catch, and is expressed in figures by the pack, the above statements display the serious extent of the depletion in that run to that district, and fully justified the statement made by you last summer at the Vancouver meeting of the Canadian-American Fisheries Conference, "that the run of sockeye salmon to the Fraser River is perilously near to extermination."

The Department's report of four years ago, in dealing with the conditions of the spawning-beds of the Fraser, stated that the beds contained less sockeye than I had previously observed there. It is therefore not surprising now to learn that the run this year was so limited.

Condition on the Spawning-beds of the Fraser.

During the season I personally inspected the principal sockeye-spawning area of the Fraser River basin, and was assisted by Dr. C. H. Gilbert and Inspector of Fisheries C. P. Hickman. The inspection made this year, like the sixteen former inspections made by me since 1901, was conducted during the spawning period. As a result of the last inspection, I have to submit the opinion that far less sockeye reached the spawning-beds this year than in any previous one of which there is a record. In all of the great lake sections of the Fraser above Hell's Gate Canyon there were few or no sockeye, and in the lower section of the Fraser, with the exception of Lillooet Lake, there were less sockeye than previously reported.

The number of sockeye that reached Hell's Gate, in the narrow canyon of the Fraser above the village of Yale, was smaller than in any former year. The Indians who fished there, under daily supervision of Dominion fishery officials, caught less than 1,500 sockeye. They could have taken more, and would have done so, but for the fact that the run of spring salmon was above the average and satisfied their own demands, and they were not permitted to sell either fresh or salted fish to the whites.

The Indians who fished at the canyon in the Fraser above the mouth of Bridge River caught less than 400 sockeye, and those engaged on the Fraser at Chimney Creek and at Soda Creek took less than 100 at each location, while those fishing just below the mouth of Quesnel River were unable to catch any sockeye at all. No sockeye were reported from that section of the basin above the mouth of Quesnel River.

The conditions at Quesnel and Chilko Lakes are best evidenced by the statements that less than fifty sockeye are recorded by the Provincial watchman as having entered Quesnel Lake, and that it took Dr. Gilbert and myself, operating separately at the principal Indian fishing-places on the Chilcotin River, a week to obtain scales and measurements from 100 individual sockeye. Throughout the season the Chilcotin Indians at all their fishing-places caught less than 500 sockeye. Dr. Gilbert was desirous of obtaining scales and measurements of sockeye entering the Chilcotin and Quesnel Rivers. As stated, it took a week to get the data from the Chilcotin, and we could get no data from the Quesnel because so few reached that river, and they came so scatteringly that none were caught.

Not to exceed 100 sockeye are known to have entered Seton-Anderson or Adams Lakes, though the creeks leading from them were under observation throughout the season, and less than 100 sockeye were found in any of the many tributaries of Shuswap Lake.

Indians resident along and near the Thompson River again had no fishing-platforms on the banks of that river, and are not believed to have taken fifty sockeye or any pink salmon this year. No pink salmon were reported in the Fraser above Hell's Gate.

In former reports on the spawning area of the Fraser I have dealt separately and at length with conditions at all the principal districts in the upper section of the basin. I do not do so this year because the whole story is told in the above statements. There were too few fish in those waters this season to warrant further records. No future importance need be attached to the few that did spawn there.

The number of sockeye which reached the spawning area of the lower section of the Fraser basin this year were less than four years ago, and the hatcheries collected less sockeye-eggs. The run to the streams at the head of Lillooet Lake was less than four years ago. The hatchery maintained there collected 12,000,000 sockeye-eggs, as against 15,000,000 four years ago. The run was, however, greater than last year. In addition to the fish that reached the hatchery this season, it is to be noted that the Dominion Fishery and Indian Officer Grant, who was stationed at the portage between Harrison and Lillooet Lakes, records that the Indians fishing at that portage took over 6,000 sockeye. As in recent years, by orders of Officer Grant, the Indians retained only the male fish caught by them. The females taken were returned uninjured to the water, and were thus enabled to reach the streams at the head of lake.

The number of sockeye that entered Harrison and the lower lakes was less than four years ago, and less eggs were collected for the hatcheries.

The total number of sockeye-eggs collected for the hatcheries on the Fraser from its tributaries was 12,210,000 less than four years ago.

Chief Inspector of Fisheries Lieut.-Colonel F. H. Cunningham reports that some 20,000,000 sockeye-eggs taken from streams in Alaska were donated and shipped to the Harrison Lake Hatchery by the United States Bureau of Fisheries, and that they will hatch them and the young be liberated in the vicinity of Harrison Lake. This addition to the hatcheries gives a total of 32,210,000 sockeye being incubated for liberation in the Fraser, as against 22,484,000 in 1914.

REPORTS FROM THE DOMINION HATCHERIES OPERATING IN BRITISH COLUMBIA IN 1918.

	Sockeye.	Spring.	Cohoe.	Chums.	Pinks.
Harrison Lake	1,873,000	3,025,000	42,000	396,000	.....
Cultus Lake (tributary to Harrison)	3,120,000	.....	1,038,000	.....	.....
Westminster (tributary to Harrison)	.....	.....	636,000	.....	40,000
Pemberton	4,000,000	40,000	.....	.....	.....
Pitt Lake	3,217,000	.....	163,000	23,000	.....
Kennedy Lake	2,500,000	.....	.....	.....	.....
Anderson Lake	2,313,000	.....	176,000	.....	.....
Babine (Skeena River)	8,000,000	.....	.....	.....	.....
Rivers Inlet	2,600,000	.....	.....	.....	.....
				Steelhead.	
Cowichan	.....	417,404	2,019,000	37,000	.....

I have, etc.,

JOHN PEASE BABCOCK,

Victoria, B.C., December 1st, 1918. *Assistant to the Commissioner.*

THE SPAWNING-BEDS OF RIVERS INLET.

Hon. Wm. Sloan,
Commissioner of Fisheries, Victoria, B.C.

Sir,—I have the honour to submit the following report in respect to the conditions existing on the spawning-beds at Rivers Inlet for the year 1918:—

Leaving the cannery at Rivers Inlet on October 7th, I proceeded to the lake with the intention of going right through to the headwaters, a distance of between thirty-eight and forty miles, but the weather, which had permitted the inspection of the spawning-beds of Smith Inlet to be made under such favourable conditions, suddenly changed, and created such a sea on Lake Owikeno by the high wind that it was considered advisable to remain near the mouth until an improvement was shown.

Eventually reaching Jeneesee Creek, a distance of twenty-two miles, I inspected the spawning-beds situated at this point. The creek, which in 1913 and 1914 was literally swarmed with sockeye salmon, and commented upon very favourably in my reports for those two years, was practically empty; beyond one or two small schools swimming about in the creek and a few noted breaking water outside on the gravel shores of the beach, there was nothing to indicate an exceptional run to this tributary. The hatchery officials, who usually obtain their eggs from this stream, had been unsuccessful in securing any so far. Since the experience of the past two or three years has shown that the fish have arrived late, it was deemed desirable to again visit this section on my return from the headwaters of the lake, in case I was too early. The logs and jams which litter the stream all the way up to the falls form a formidable barrier to the number of sockeye which eventually reach these beds. I do not remember, in the six years of my experience of this particular stream, noting so many small grilse as on this occasion. Schools of them were observed spawning on the gravel-bars right up to the falls, having managed to wriggle their way through the fence erected by the Dominion Hatchery. The small number of sockeye salmon which had arrived at the creek were of good average size and compared favourably with the 1914 run.

The Machmell River, another tributary flowing directly into the lake at this point, although one of the largest of the streams to be met with in this watershed, does not, nevertheless, appear to be favoured by the sockeye salmon. Owing to the high stage of the water at this time the inspection was conducted under extreme difficulty. The thick muddy condition of this glacier stream did not favour accurate observation of the likely numbers spawning on the beds, but indications higher up, where the river-bed was visible, did not point to a big run; very few fish were seen. The swift-running river precluded all attempts to secure a collection of eggs or scales for the Department.

It was hoped that the run of sockeye salmon up the Nookins River, a tributary to the Machmell, would make up for the indifferent number seen at the latter point, but an examination of this stream disclosed similar conditions. It was difficult to believe that these spawning-beds which in former years have been so plentifully seeded could be depleted to the extent shown this year, especially as the spawning-beds were full of sockeye salmon in 1913 and 1914. There were no log-jams or other obstructions (with the exception of the log-jam two miles from the mouth, which does not, however, cause an obstruction to the fish) to account for the failure of the salmon to run.

On arriving at the head of the lake next day, I made camp and inspected the tributaries at this section. The Indian River, which was examined under the most favourable circumstances, was absolutely empty; not one sockeye was visible as we made our way through the rapids to the falls. There were no log-jams or other obstructions to account for the failure; therefore it cannot be due to this cause. The Cheo River, one of the finest spawning-grounds for the salmon, and upon which the early-running sockeye deposit their ova, again showed up very unsatisfactorily in comparison with the large numbers noted on the occasion of my visit there in 1913 and 1914. Very few fish were spawning on the beds as we made our way up to the falls, four miles and a half distant, and only an occasional glimpse of them could be obtained in the deeper portions of the river. No collection of eggs was made possible owing to the agile salmon eluding every effort to spear them.

The log-jam at the bend three miles up had not materially changed since my visit last year. It affords no real obstruction unless the falls are opened to permit the salmon reaching the spawning-beds above. If, as has been suggested, a fish-ladder is built through the falls, then it will become necessary to blast out the jam to provide passage to the onward movement of the fish.

In making the examination of the Washwash River last year, I drew attention to the huge jam that obstructed the mouth and prevented the salmon reaching the extended spawning-beds above. I am glad to report this year that a portion of the obstruction had been washed away by an extreme freshet and permitted the salmon to reach these beds. The log-jam, however, is a source of danger and may at any time effectually block this river.

Proceeding to the falls two miles and a half distant, I noted the comparatively small number of sockeye spawning on the beds, the majority having spawned out, but I was able to obtain a collection of both salmon and scales from this stream.

The unsatisfactory state of the spawning-beds of the three rivers suggested that the unavoidable delay in reaching them may have been the cause for the poor results shown, but Indians who had been camping here for the past six weeks stated that even at the height of the run of sockeye, three weeks prior to my visit, very few had come into the rivers in comparison with former years, and that it was only with extreme difficulty sufficient numbers were obtained to supply their winter's need. It is evident, therefore, that the outlook does not favour a big run to this section of the lake four or five years hence. In size the run of sockeye salmon came well up to the average.

Returning from the head, I inspected Sunday Creek, a small mountain stream flowing into the lake. In my report for last year I drew attention to the change in the course of the channel; the original one had been obliterated. I found again another change where an extreme freshet had burst its way through, changing the course again and obliterating the channel formed last year. It is to be feared, therefore, no reliance can be placed upon this stream to successfully fulfil its functions year by year. In the Narrows, where formerly large numbers of both sockeye and cohoe salmon were seen on the beds, was found to be lacking of both species on this occasion.

The Sheemahant, the largest and most productive river of the lake, and which in past years (with the exception of 1916) had received its full complement of both sockeye and cohoe salmon, failed this year to sustain its reputation; it fell far short of the prolific numbers encountered here in 1913 and 1914. A few sockeye were observed spawning on the riffles as we proceeded up to the falls, but owing to the high stage of the water it was difficult to gauge with any degree of accuracy the real number actually on the spawning-beds; there was no room left for doubt, however, that the run this year has dropped to approximately 25 per cent. of the 1913 and 1914 runs. The few sockeye salmon observed were all fine specimens of the race and came well up to the average. No log-jams obstruct this fine river, which is open to the salmon up to the falls eighteen miles distant.

In making the return visit to Jeneesee Creek, I was quite prepared to see a big change in the number of sockeye salmon spawning on the beds, but in this I was disappointed; very few had arrived. The hatcherymen had obtained one or two boxes of eggs, but from the small number of fish seen in the creek it did not look very hopeful for the requisite number necessary to fill the hatchery being produced. In comparison with the 1913 and 1914, the run of sockeye to Jeneesee is a failure.

I found great difficulty in accurately estimating the run of sockeye salmon to the Asklum River owing to the tremendous volume of water flowing down at the time of my visit; it was necessary to go right up to the falls, and then work our way down the sides of the river, before an opportunity was afforded to view the spawning-beds with any degree of accuracy. A fair number were observed spawning on the riffles, and should provide for a fair run returning here four or five years hence. In examining several of these fish I found they were not yet ready for spawning, and indicated their early arrival from the lake. They were fine specimens of the sockeye race, and here again came well up to the average of the other rivers. In estimating the run I have to record a decrease to approximately 50 per cent. of the 1913, 1914, and 1915 runs.

Quap River, in comparison with former years, is a complete failure. Calling in there on my way up the lake, I noted a few sockeye spawning on the beds below the fence and a small number had reached the pen; concluding that this was only a forerunner of a big run which has never failed so far to eventually make its appearance, I was certainly surprised to find on my return

that little improvement had been shown. The hatchery officials had met with little success in their endeavour to fill the hatchery and had barely obtained 1,000,000 eggs.

As the capacity of the hatchery is about 14,000,000 eggs, it is obvious that unless a big run entered very soon their efforts would be doomed to disappointment. Such a situation has occurred, so I am given to understand from information courteously supplied by the hatchery officials; only about 3,000,000 eggs were secured by them.

The conditions above the fence have not changed in any way; huge trees and log-jams which obstruct the river right up to the falls are still in evidence, and will entail heavy expense in removing to permit the salmon reaching the extended spawning-beds.

The Dalley River, situated directly opposite Quay, showed little improvement. Indians who had been up here three or four times during the last five weeks confirmed the lack of sockeye salmon seen on the occasion of my visit there, and reported that they did not remember having seen so few fish spawning on the beds. This has in former years been regarded as one of the most productive streams of the lake. In 1913, and especially in 1914, the sockeye salmon were seen in dense masses. It is to be feared that this river is also a failure. No log-jams interfere with the progress of the salmon up-stream.

The hatchery creek appeared to be well stocked with sockeye salmon, the fine spawning-beds showing to great advantage; the bars outside were thickly covered with spawning fish and in size attained a high average.

The facilities for erecting a fence to obtain eggs for the hatchery are by no means favourable owing to the raging torrent of water which comes down after a heavy rain; consequently the large numbers of spawning sockeye cannot be utilized by the hatchery for artificial propagation, the experience of past years precluding the erection of a fence.

All along the shores at the mouth of the lake the sockeye salmon were observed in very large numbers; also the fine spawning-beds lying around and close to the Indian rancherie were thickly covered, and for the first time showed up in favourable contrast to the poor run of sockeye salmon to the other tributaries of Lake Owikeno.

Spring salmon were breaking water all the way down through the rapids of the Owikeno River and compared very favourably with former years.

I noticed the cohoe salmon repeatedly breaking water as we proceeded back from the lake; one or two had been caught in the pen at Quap River and indicated by their appearance early arrival from salt water. I have no doubt that later on the spawning-beds will receive their full complement of this species of salmon.

In reviewing the results of the inspection of the Rivers Inlet watershed, I am of the opinion the serious shortage of sockeye salmon disclosed by a visit to these beds, and amounting to approximately 25 per cent. of the 1913, 1914, and 1915 runs, will have a correspondingly serious effect on the number of adult sockeye which will return from this season's spawning.

It may be recorded here that an exceptional run of humpback salmon invaded the inlet during the sockeye-fishing season and permitted some of the canneries to put up large packs. The same peculiar conditions were experienced in other sections of the district, notably at Bella Coola and Kimsquit, where abnormal numbers were caught by the fishermen, who made big money in consequence, some of them making between $3,000 and $4,000.

In conclusion, I wish to express my indebtedness to G. C. Johnston (manager) and J. Dawson, of Rivers Inlet Cannery; Captain Hamer (Superintendent) and J. Reid (Foreman); and the men at the various spawning camps.

I have, etc.,

Arthur W. Stone,

Fisheries Overseer.

Rivers Inlet, B.C., November 10th, 1918.

THE SPAWNING-BEDS OF SMITH INLET.

Hon. Wm. Sloan,
Commissioner of Fisheries, Victoria, B.C.

SIR,—In obedience to instructions from the Department to inspect the spawning-grounds of Smith and Rivers Inlets respectively for the year 1918, I have the honour to submit the following reports:—

Proceeding to Smith Inlet to undertake the inspection of this watershed first, I arrived there on September 22nd, and after making arrangements with Indians started for Long Lake the following day.

Bearing in mind the extraordinary number of sockeye salmon seen on the spawning-beds at this point in 1914, it was certainly surprising that the run this year did not come up to expectation, and that the two canneries operating here were only able to put up a total pack of about 14,000 cases of sockeye salmon between them. Comparing this with the total pack of about 28,000 cases put up by the Smith Inlet Cannery in 1914, it will be seen there must be some explanation for the decrease shown. I am of the opinion, after closely reviewing the spawning-beds, that the poor results are due to the following reasons: A decided decrease in the number of sockeye salmon reaching the spawning-beds following a comparatively poor run of fish up the inlet. In comparison with the exceptionally big run which invaded the inlet in 1914, and correspondingly large numbers reaching the beds in that year, it was a distinct disappointment—i.e., if the four-year fish were the predominating factor in that year—to find the beds had not received their complement of spawning fish. Another reason may be given in the extra number of gill-net fishermen empowered to fish this inlet in comparison with former years; their nets, which were distributed over the inlet in large numbers, disorganized the schools of salmon proceeding up the inlet, and instead of schooling up at the seining-grounds went right through and on to the lake. I am given to understand from the seine-net fishermen that only one fairly big haul was made by them during the whole of the run.

The inspection of the spawning-grounds was made under very favourable conditions, fine weather prevailing all the time, and the rivers which last year precluded accurate observations, due to exceptionally bad weather, were low and permitted me to observe them without interruption.

The Docee River (the overflow to the lake) was well stocked with spring salmon; a very large number were seen in the clear-running water making their way up; also the fine gravel spawning-beds at the mouth of the lake contained large numbers. I am able to record a substantial increase in the number of spring salmon in comparison with former years.

At no previous inspection have I noted so many cohoe salmon as on this occasion; schools were observed swimming around and intermingled with the springs, which from their healthy-looking state proclaimed their early arrival from salt water. Indications pointed to the spawning-beds receiving their full quota of eggs from this species of salmon.

The run of sockeye salmon to Quay Creek, a small stream situated about seven miles from the mouth of the lake, although inspected under the most favourable conditions, showed a falling-off, and presented a great contrast to the numbers seen here in 1914. Schools of these fish were swimming around outside in the shallow waters of the lake, which no doubt will be the means of plentifully seeding the beds later on.

No exceptional brood, however, may be expected from the adults which will eventually return to this stream from this season's spawning. The run may be compared to the number reaching this stream in 1915.

Proceeding to the head of the lake, we made camp at the mouth of the Geluch River. In making our way through the rapids to the falls later, it was satisfactory to note that the reputation of this fine spawning stream, although not bearing fruit to the same extent as in 1914 and 1915, nevertheless received its full quota of spawning sockeye, which I estimate came within 25 per cent. of the number seen on these beds in the years previously mentioned; they were fine healthy-looking specimens of the race and compared in size to the 1914 run.

Each riffle appeared to be thickly covered until we reached the spawning-beds just below the falls, where the few sockeye observed in this portion of the river presented a vivid contrast to the dense masses which lined the beds in 1914.

No log-jams or other obstructions impeded the progress of the salmon up-stream. A few small grilse were observed in this river for the first time in my inspection of these beds.

I was very disappointed with the run of sockeye salmon to the Delabah River. In 1914, it will be recalled, large numbers were observed both in the river and in the shallow waters of the lake outside; great stress was laid upon the unsuitability of these beds for the propagation of salmon spawn, and suggested the benefit a hatchery would provide to counteract the all too apparent wastage which was manifest in that year. The relatively small run of sockeye which reached the beds bears a great significance in relation to the warning given at that time.

In making my way up to the falls fair numbers were noted spawning, but did not by any means reach the high standard attained in 1914; the beds should be fairly well seeded, however. In size the sockeye were fine specimens of the race and compared very favourably with the 1914 run.

Stretching from one end of the bay to the other, the fine gravel spawning-beds of the lake presented a very empty appearance in comparison to the milling mass of sockeye noted here in 1914; beyond one large school which was seen waiting at the mouth of the river, there was no indication that the remarkable run would be repeated this year.

In making a comparison, I estimate the run closely resembles that of 1915, or only about 25 per cent. of the total run to this section in 1914. No log-jams or other obstructions interfere with the free movement of the salmon in this river.

Returning to the mouth of the lake, the cohoe salmon were observed breaking water frequently, but none so far had reached the spawning-beds. A late run of these fish appear to have entered Smith Inlet only after the canneries had ceased operating, with the result that some fishermen who had made big hauls were unable to market their fish. One or two canneries from Rivers Inlet, however, came to their assistance later.

The run of humpback salmon was very satisfactory and permitted the canneries to put up an average pack.

In summarizing the results of the inspection at this watershed, I am of the opinion that the adult sockeyes which will return from this season's spawning will by no means approach the vast numbers seen on the beds in 1914, but should result in a run equal to that of 1915.

In regard to the run of cohoes, humpbacks, and spring salmon, I have reason to believe that the favourable impression formed this year will result in a good run from each of this species of fish on their return as adults.

In conclusion, I wish to express my indebtedness to G. F. Harris, Manager of the Wallace Fisheries at Smith Inlet.

I have, etc.,

Arthur W. Stone,

Fisheries Overseer.

Rivers Inlet, B.C., November 10th, 1918.

CONTRIBUTIONS TO THE LIFE-HISTORY OF THE SOCKEYE SALMON. (No. 5.)

By Charles H. Gilbert, Ph.D., Professor of Zoology, Stanford University.

I. SPAWNING SOCKEYE COLONIES IN THE TRIBUTARIES OF THE FRASER RIVER DURING THE SEASON OF 1918.

In our report for the season of 1916 we presented for the first time evidence derived from an investigation of the salmon which frequented separate spawning areas of the Fraser River. Those which were found spawning in Morris Creek were examined separately from those that spawned at the Harrison Rapids. And in like manner independent studies were made of the spawners at the Harrison Hatchery, in the Birkenhead River at Pemberton, in Pitt Lake, in Cultus Lake, and in the Chilcotin River. The object of the investigation was to throw light on the much-mooted question as to the return of the mature spawning salmon to that particular part of the river-basin in which they had been hatched and reared. In the answer to this question a number of possibilities must be considered.

(1.) There may conceivably be no tendency for a salmon to return to any definite spawning district, or to any geographically distinct group of spawning districts. In such case any sockeye entering the Fraser would be as likely to spawn above as below the canyon, and as likely to spawn in any one tributary as in any other. Every spawning-bed in that event would contain individuals which had been hatched and reared in widely different portions of the basin.

Each spawning area would draw indifferently on the common stock of migrants, and the salmon frequenting it would necessarily agree in their characteristics with those frequenting each of the other spawning areas throughout the basin. There would be no basis for differences of any description. The salmon spawning in different parts of the basin would agree in their average size, as adults, and in their early history as fingerlings migrating seawards. They would agree in the relative numbers of four- and five-year fish, in the relative numbers of those which had spent one year or two years in fresh water after hatching, or had proceeded to sea as soon as they were free-swimming. All the groups and all the variations of characters which we find in the main run examined off the mouth of the river would be repeated in approximately equal proportions on every spawning-ground. Such would inevitably be the case if the salmon passed indifferently to the various spawning areas without reference to their native habitat.

On the other hand, if differences are found to exist in the populations of distinct spawning districts, this must be considered direct evidence that segregation has occurred, based on some principle which has determined that certain individuals in the common run pass to one spawning area while other individuals go elsewhere to spawn. The only principle adequate to explain such segregation, if it generally occurs, would be the return of fish to spawn in their native tributaries.

This principle obtains, as we have abundantly demonstrated, as between different river-basins, even when these are of very limited size and have their outlets to the sea in close proximity to each other. In their passage to these minor streams along the salt-water channels the schools of fish are often very intimately mingled, and they separate only as the river-mouths are approached. Thus, in the vicinity of Namu, on Fitzhugh Sound, gill-nets operated along shore capture in about equal numbers at the same time sockeyes which are bound for Bella Coola and those which are bound for Kimsquit. These can be distinguished by characteristic scale-markings. The two schools are running intimately mingled along the same channels. Where they separate has not been determined. The greater part of them may pass up Burke Channel together, or it may be the Kimsquit fish may take the Dean Channel. But by the time Bella Coola and Kimsquit are reached complete separation has occurred.

The case would seem not greatly different from that of fish bound for different tributaries of the same river. Conceivably, the schools may be mingled along the main channels of the river and become separated as their respective tributaries are reached. If the populations of these tributaries show distinguishing characteristics, no other satisfactory explanation presents itself.

(2.) We must consider also the possibility that a partial segregation of spawners occurs, but not a total one; that within certain limits indifference exists as to the precise spawning-ground frequented. Thus the up-river fish may predominately run early and proceed above the canyon, passing without selection into any stream that becomes available; while the late-running fish may enter the Harrison, the Pitt, and Cultus Lakes again without determinate destination. That this supposition is without validity for the lower river becomes evident from the fact previously emphasized that the fish entering Pitt Lake are so widely different from those entering Cultus Lake, and that even the different spawning-beds of the Harrison can usually be shown to possess individual characteristics of unquestioned significance.

With regard to the river above the canyon, the case is not so clear, partly, no doubt, from lack of adequate material. The runs of the upper river have of late years become extremely attenuated. No material at all adequate has been obtained from any up-river tributary except the Chilcotin, and because of permanent depletion we may now find it too late to secure any. A small run which makes it possible for natives to secure a few fish for food from the main channels of the up-river may yet disappear for all practical purposes when it becomes widely distributed among the tributaries. And unless material can be so secured after final segregation has occurred it is useless for our purposes. The differences which distinguish fish spawning in contiguous areas are usually of such small amount and compass that they become wholly masked when two or more races are mingled.

This may be the case even at the mouths of the main tributaries. More than one spawning district, each with its special characteristics, may be found within a given tributary. The Harrison River, for example, has at least four spawning areas. Scales and other data collected solely at the mouth of the Harrison, or in its lower course, would be valueless. The different strains would be mingled and their characteristics obliterated. The nearer the material is obtained to the final spawning-grounds, the greater its value for investigations of racial divergence.

(3.) Where spawning populations show distinguishing characteristics the inference is clear and unavoidable. A physiological barrier has existed—the racial habit of return at maturity to spawn in the native stream—for so long a period that minor differentiations have developed and a strain or sub-race has been formed. But what are we to conclude in cases where the colonies of two distinct spawning areas present no characteristics by which we can distinguish them? Obviously, we must infer either (*a*) that segregation in their case has not occurred, or (*b*) that it has occurred but has not been effective in producing divergence between the colonies. If the first of these were true, it would signify that the "home-stream" instinct was in most cases rigidly operative, while in one or more instances within the same river-basin it was wholly in abeyance.

The second supposition would seem *a priori* far less improbable. Complete segregation of spawning fish may occur, so that each individual returns to the stream in which it was hatched and reared, and yet, in certain instances, separate colonies may have failed to develop distinct methods of growth or of habit by which they can be distinguished. Failure to discover distinguishing characteristics between populations of separate spawning areas need not indicate then that their progeny will fail to return at maturity each to its native stream.

This process may have been in operation for many thousand years. The two colonies may have been wholly distinct and self-perpetuating for a very long period and yet no differences have developed. If we should adopt distinctive marks for the young from each of the two streams on their downward migration to the sea, it might be shown at maturity that each stream contained spawners with a single mark only, the one that had been applied to the young from that stream. Yet the adults from the two tributaries might be otherwise indistinguishable. Negative evidence in this case proves nothing. But if affirmative evidence is found, it is conclusive. If, in fact, differences are found to exist, there is no alternative to our acceptance of the home-stream theory.

Different tributaries of the same river may be quite unlike in the sharpness of the characteristics by which their colonies may be recognized. Cultus Lake, a tributary of the Lower Fraser, possesses a strongly marked race of small salmon, pale in colour of flesh, poor in oil, scarce

worthy of the name of sockeye; while Pitt Lake, also tributary of the Lower Fraser, is frequented by a large race the opposite in all respects of the Cultus Lake colony. But we have been unable to distinguish the fish of Morris Creek, tributary to the Harrison River, from those spawning in the lake-gravels in front of the Harrison Hatchery and in the small stream that supplies it. In this latter case we have obtained no direct evidence of segregation; but it is rendered highly probable by the more numerous instances in which it can elsewhere be demonstrated.

The most important investigation during the season of 1918 consisted in an attempt to test the conclusions which we had based on the material of 1916 by a re-examination of the colonies frequenting the same spawning-grounds previously reported on. It was hoped to secure, also, material from additional spawning-grounds above the canyon, from which nothing heretofore had been obtained.

The season of 1918 was peculiarly ill-suited to the purpose. In the recent history of the Fraser we have grown accustomed to noting that each successive year is the worst in the history of the industry, or is in any case distinctly worse than its representative in the last cycle, four years previously. But the extent of the disaster in 1918 was unexpected and overwhelming. A run of sockeyes to the Fraser can hardly be said to have occurred. Under such circumstances the numbers that escaped to the spawning-grounds were most limited. Along the main river-channels were a few locations, like the canyon above Yale, the Bridge River fishing-grounds above Lillooet, and those above the mouth of the Chilcotin at the Chimney Creek Bridge and at Soda Creek, where natives by persistent dipping secured a few fish. Material was obtained at all these points, but for reasons already stated it was of less value for the purposes of the present investigation. In all these river-channels it was apparent a number of local races were mingled. Because of this the range of variation in all the characters examined was excessive, far greater than when we have before us data obtained from a single spawning area.

In addition to these main-river locations, we were successful in securing a limited amount of material from the Chilcotin River at Hanceville and at Fish Canyon near its mouth; from the Birkenhead at Pemberton; from the Skookumchuck above Harrison Lake; from the Harrison Hatchery, Morris Creek, and the Harrison Rapids; and from Pitt Lake. For much of this material we have to thank the very generous co-operation of Alex. Robertson, Superintendent of the Harrison Lake Hatchery, and T. W. Graham, Superintendent of the Pemberton Hatchery on the Birkenhead. To both of these gentlemen we extend our grateful acknowledgments.

In general, it can be stated that the examination of this material completely supported and verified the conclusions reached in 1916. With regard to the spawning-beds below the canyon, we affirm without qualification that they are as distinctively populated as though they were located in separate streams independently entering the sea. Additional material only emphasizes this fact. Not only were the different colonies in 1918 marked by distinctive characters, but these characters were the same for each colony as those noted in 1916. We have then the picture of a number of self-perpetuating sub-races, each of which has acquired certain minor habits of growth, of migration, of age at maturity, of length of life in fresh water, of colour and quality of flesh—the same characters, in short, which in various combinations characterize the races of the separate river-basins of the simpler sort.

A very conspicuous instance of racial differentiation is furnished by the Harrison watershed. We do not know how many distinct spawning areas it may have contained. Several minor colonies, like that frequenting Silver Creek, are now practically exterminated. There were spawning areas doubtless in Lillooet and in Tenas Lakes, but no records of these have reached us. A very limited number of late spawners still frequent the slack water of the main river above Harrison Rapids, the vanishing remnant of a once fine run visits the lake at the head of Morris Creek, and a considerable run still goes up the Birkenhead. Both the Birkenhead and the Morris Creek fish pass over the very spawning-beds at Harrison Rapids, but not one of them tarries there. An examination of 200 specimens, laboriously gathered at Harrison Rapids in 1918 by Mr. Robertson, failed to yield a single fish which had been spawned elsewhere than in the beds of the rapids. Not one could on even a cursory examination be confused with those constituting either the Morris Creek or the Birkenhead colony. Not one of the Harrison Rapids fish was found among over 400 specimens examined from Morris Creek, and over 200 from

Skookumchuck and the Birkenhead. No Morris Creek strays were found in the Birkenhead, and no Birkenhead fish were found in Morris Creek, in spite of the fact that all the Birkenhead fish passed the mouth of Morris Creek on their way. In these cases, evidently, the law of segregation is most strictly in force; yet it seems impossible to imagine a locality better suited to straying of the spawning fish with resulting mixture of populations. That it does not occur here, where fish pass over and pass by one another's spawning-grounds, gives confidence that the same law rules everywhere, though the evidence of it may be less compelling.

Harrison Rapids.—The most interesting colony of the Harrison is the one which spawns late in the season at Harrison Rapids. The characteristics of this colony were fully discussed in our report for 1916, page 50. The nature of the spawning area is in itself highly unusual. The spawning habits of sockeyes are generally regarded as rigidly fixed, more so than with any other species of salmon. Unlike other species, they must resort to a lake, and fail to frequent any stream, otherwise suitable, which has no lake which they can succeed in entering. The lake once attained, they spawn in the gravel-beds around its margin or ascend some affluent of the lake in search of suitable spawning-beds. The young develop mainly, if not exclusively, in the waters of the lake, frequenting the depths in the daytime, but rising to feed at the surface in the evening. Under such conditions the sockeye commonly resides over a year in the lake, sometimes over two years, occasionally over three years, before seeking salt water. Of the varying number which precociously descend to salt water in their first spring, few ordinarily survive and return at maturity.

But the Harrison Rapids spawners use gravel-bars in a shallow backwater region of the river, where they have no genuine lake conditions at their disposal, nor any lake into which the young can drop back after hatching. They have adopted, therefore, the highly exceptional method of life for a sockeye, of dropping down to salt water as soon as they are free-swimming, and while we have no data as to their mortality or the percentage of survival, it is clear that before man disturbed the balance of nature, enough survived to keep the colony in a flourishing condition. More than this cannot be said for any of the other colonies. Clearly, then, under the spur of necessity, a sockeye colony can adapt itself to the habits of sea migration in the early free-swimming fry stage, a habit rare in sockeyes, and so far as known never occurring among cohoes; but almost exclusively characteristic of humpbacks and dog-salmon, and frequent among chinooks.

The 200 specimens of Harrison Rapids spawners examined in 1918 had all had the history above outlined. Not one of them exhibited in the centre of its scale any trace of growth of the young in fresh water. All had passed down to sea as young fry before any portion of the scales had made their appearance.

It is very difficult to place satisfactorily on record the evidence for racial differentiation as observed on the spawning-beds. As previously pointed out, the scales have suffered extensive erosion during the later weeks which precede the spawning. Not only are the margins of the scales broken down and absorbed to such an extent that they no longer serve for determination of age, but the surface of the remaining portion of the scales has become more or less defaced. Absorption has taken place not only at the margins but also on the surfaces of the scales, and the lines of growth are blurred or obliterated. Enough may be preserved to render possible a detailed examination under the microscope, where the course of the ridges can be traced from such fragments as remain, by the aid of focusing at different levels. But such scales produce very unsatisfactory photographs. Nevertheless, it has seemed advisable to have a number of these from each of several spawning areas of the Fraser reproduced as a permanent record. Only the centres of the scales are figured, the worn and jagged edges being omitted.

Figs. 1 to 5 are from the spawning race at Harrison Rapids. Each contains the extensive first year's growth which occurs wholly in salt water, together with a varying portion of the second year's growth. The boundary between the two years in these cases is not a sharp one, leading to the conclusion that fry which descend to the sea in their first year suffer less interruption to their growth during their first fall and winter in the sea than is the case with those which pass their first year or their first two years in fresh water. Rarely, however, a slackening of growth in the Harrison Rapids fish at the close of their first year is indicated by a definite line of demarcation at its outer edge. When this exists there are thirty-two to forty rings or lines of growth belonging to the first year.

As was observed in 1916 and during previous years, sockeyes belonging to the type which alone frequents the Harrison Rapids spawning-beds—the sea-type—make their appearance during the latter part of the run only, at the mouth of the river and in the approaches to it. In 1916 the first to appear were taken on July 17th, and after that date they occurred constantly to the close of the season.

In 1918 the first to make their appearance at Esquimalt, from traps along the Vancouver Island shore, were found on July 14th. Not a single specimen had been found among the 250 which had been previously examined, distributed over June 17th, 20th, and 28th, July 2nd and 10th. They were present on July 14th, 18th, 21st, 25th, 29th, August 2nd, 4th, 8th, 11th, and 26th. The only dates on which examinations were made at Esquimalt after July 14th that yielded no individuals of sea-type were August 13th, 16th, and 23rd. The numbers of this type were evidently decreasing during the very last of the run.

The defective condition of the scales made it impossible to determine directly the age of the Harrison Rapids fish, but the lengths were secured, and a valuable clue can be obtained from the range in size found in three-year fish and in four-year fish of this type before they enter the river. The complete range may not be available because of the small number of individuals of sea-type which were obtained at Esquimalt during 1918. Only twenty-four in all were observed. Five were three-year males; one a three-year female; five were four-year males; thirteen were four-year females. The three-year males ranged from 20½ to 24 inches long; the four-year males from 26 to 28 inches. Comparing these figures with the Harrison Rapids column in Table I., it is seen that the majority of the Harrison Rapids males are from 25 to 29 inches long, and that the lengths of these, when tabulated, form a fairly regular curve, with the mode at 27. Lying below 25 inches, extending from 17½ to 24½, are sixteen thinly scattered records, which form no part of the curve referred to. As these two elements in the table agree closely with the observed lengths of three- and of four-year males obtained in salt water where age can be determined, we are justified in concluding that approximately all Harrison Rapids males between 17½ and 24½ inches long are in their third year, while those between 25 and 29 inches long are in their fourth year.

The single three-year female of this type secured from salt water in 1918 is 20½ inches long, while thirteen four-year females range from 24 to 26½ inches. Table II. gives the length distribution of Harrison Rapids females, all but three of which fall within the scope from 23 to 26 inches and form again a regular curve, while three individuals are 20, 22, and 22½ inches long respectively. It is highly probable that the three last mentioned are in their third year, while the remainder are in their fourth year. The earlier dates, on which sea-type individuals appeared in the run, produced only three-year males and four-year females, the other groups appearing subsequently.

In 1918, as in 1916, we failed to find any individuals of sea-type spawning in any part of the Fraser River basin other than Harrison Rapids. Upwards of a thousand specimens were examined from other spawning districts, in which it might be thought an occasional sea-type individual might be found, if only as a stray. The fact that not one individual was discovered elsewhere, when coupled with the further fact that every Harrison Rapids sockeye belonged to this group, furnishes the strongest possible evidence of the return of spawning fish to their native districts.

Morris Creek.—This stream offered in the early days one of the most valuable spawning districts in the Harrison watershed. In his report for 1902, pages 24 and 25, J. P. Babcock states: "Morris Creek and Lake are insignificant bodies of water, but as a spawning-ground for the late run of sockeye, and from the standpoint of artificial propagation, they constitute one of the most important and valuable points on the Fraser. The Dominion Government has operated a spawning-station here since 1885, and with the exception of the year 1900 has never failed to take eggs. All the salmon-eggs taken by the Dominion in this Province up to 1901 were secured at this station." Much later than 1901 Morris Creek still served as the principal source of eggs, first for the Bon Accord Hatchery near New Westminster, and later for the Harrison Lake Hatchery. None of the fry in the early days were returned to Morris Creek, as it was not believed that such procedure was necessary to maintain the spawning run. Even

in 1902 (*l.c.*) Mr. Babcock wrote: "It is generally believed that fish bred in a given watershed, such as the Fraser, return to it upon reaching maturity, and there is considerable evidence to warrant it. It has not, however, been settled, and probably never will be, that the fish bred in a given tributary of a large river seek only that tributary to spawn." Believing, then, that any increase in the run to a large river would equally benefit all the tributaries, there seemed no reason for laboriously returning fry to Morris Lake in order that they should return there and help maintain the spawning run. Knowing, as we now do, that salmon will in general return to the district in which they are liberated, the fate of the Morris Creek run seems to have been inevitable. It has steadily dwindled with the years until it can no longer be depended on for any considerable take of eggs. Natural propagation was reduced to a minimum in order to obtain eggs for the hatcheries, while the hatchery-reared fry did not at maturity return to Morris Creek. The same has been the history of Silver Creek, where "the Dominion Government placed a weir in August, 1902, and took nearly two and a half million eggs, which were transferred to the hatchery near New Westminster." The run in Silver Creek is now practically extinct, and we cannot doubt that this process has been hastened by failure to replenish its run through the planting of fry. No better examples than these can be found of the necessity of working out completely the entire life-history of our commercial fishes before it is possible to propagate them with success or to legislate wisely for their protection. Failure to follow this principle has discredited hatchery-work from the beginning, and has led to the well-founded suspicion that in many instances they have been more of a detriment than an advantage to the runs.

Morris Creek would seem to have been an ideal hatching and rearing ground for the sockeye. The enormous run entering this very insignificant stream in early days furnishes evidence of extraordinarily favourable conditions. Examination of the scales of the fish now running shows a striking uniformity in their development. They form an impressively homogeneous lot. All have large sharply defined nuclear regions, testifying to a vigorous growth during their first year, which is uniformly passed in the lake. The number of nuclear rings varies from fifteen to twenty-eight, with the mode at twenty. The frequency curve is given in Table III. In all probability the fingerlings on migrating from the lake in the spring of their second year were 4 to 6 inches in length, and better fitted to cope with their enemies than the smaller weaker yearlings from less favourable localities.

Figs. 6 to 8 give typical centres of Morris Creek scales. No individuals from this district had lived two years in the lake before migrating, and none had proceeded to sea in their first year. The length distribution, given in Tables I. and II. in the columns for Morris Creek, seems to indicate that the majority of the fish were in their fifth year. The modal length for the males at 27 inches and for the females at 25 or 26 inches closely agrees with that usually characteristic of five-year Fraser River fish.

Birkenhead River.—This affluent of the Harrison has now the most reliable sockeye run, and is the only spawning district of value remaining in this watershed. Its present importance is due in part doubtless to the fact that it was not drawn on for hatchery purposes until a much later date than Morris Creek and the Harrison Lake region, and in perhaps larger part to the significant fact that the output of the hatchery is constantly planted in the Birkenhead and helps maintain the run.

The characteristics of the Birkenhead race in 1918 are in general the same as those described for the 1916 run. The growth of the fingerlings in fresh water must be much less than in the case of the Morris Creek and Harrison Lake fingerlings. The nuclear area of the scale averages small, with densely crowded rings. These were somewhat more numerous in 1918 than in either of the two years preceding and the extremes range far more widely. The lot in 1918 was far less homogeneous than in 1916 and 1917, even those taken at the Pemberton Hatchery presenting an unexpected amount of variation. While the nuclear regions average small and the number of rings in the great majority of individuals is less than sixteen (the mode lying somewhere between eight and eleven), occasional specimens have nuclear rings running as high as nineteen, twenty, and twenty-one. Furthermore, the frequency curve for nuclear rings in 1918 has none of the regularity so well defined in 1916 and 1917. The irregularities in 1918 are equally marked and

are similar, whether the specimens were procured at Skookumchuck or at the Pemberton Hatchery on the Birkenhead. As seen in Table III., there is at both localities a mode at eight rings, one at eleven, and a less regularly defined one at fifteen. Yet, so far as known, all come from the same spawning-grounds. It is not clear what significance, if indeed any, attaches to this circumstance. In spite of the variation in nuclear rings, racial peculiarities are apparent. Especially marked is the small size of the first year's growth in the sea, a character that was also conspicuous in the two years preceding. Occasionally this is carried so far that the first year's growth in the sea resembles a second year in a lake, but only one undoubted two-years-in-lake individual was observed.

It was found possible to determine age from the scales in a larger percentage of individuals than was possible in other spawning localities. Both at Skookumchuck in the Lillooet River and at Pemberton on the Birkenhead between 40 and 50 per cent. of all specimens could be grouped by age. This does not, however, give a reliable estimate of the relative numbers of four- and of five-year fish present. With imperfect scales, the age of five-year fish is more readily determined than of four-year fish. Four-year scales cannot be determined unless some portion of the original margin of the scale is preserved, thus demonstrating that a fifth year's growth had not been present when the scale was intact. But five-year scales are unmistakably such in cases where not only the margin but the entire fifth summer's growth has been lost. If the last winter's band of crowded rings is present beyond the growth of the fourth summer, or any part of such band, the fish was evidently in its fifth year. The practical absence of six-year fish of the one-year-in-lake type in the Fraser River facilitates this determination.

In 108 specimens from Skookumchuck, the age was ascertained in fifty-four, or exactly one-half. Thirty-four of these were in their fourth year (twelve males and twenty-two females) and twenty were in their fifth year (twelve males and eight females). In 180 specimens from the Birkenhead, age could be determined in seventy-eight, or 43 per cent. Of these, forty-one were in their fourth year (three males and thirty-eight females) and thirty-seven in their fifth year (twenty-one males and sixteen females). If these proportions were reliable, we should have 37 per cent. of five-year fish at Skookumchuck and 47 per cent. at Pemberton, the percentage for both localities being 43. As stated above, this percentage is too high. The minimum percentage of five-year fish can be obtained by assuming that all the undetermined individuals were four-year fish, which reduces the proportion to 19 per cent. Obviously, this extreme assumption cannot be justified. If one-fifth of the undetermined individuals were five-year fish, there would be slightly over 30 per cent. of five-year fish in the Birkenhead-Lillooet section, and this must be considered a fairly satisfactory estimate. The percentage of five-year fish of the one-year-in-lake type in the total run, as determined by samples taken frequently throughout the season at Esquimalt, was 23, and these ran largely in the early part of the season. The percentage during June and the first half of July was higher than that indicated.

Pitt Lake.—Over 200 specimens were examined from Pitt Lake, and of these only twenty-five could have their age determined. These proved to be in their fifth year in every instance except one, the latter having spent two years in the lake as a fingerling and having returned from the sea in its sixth year. Reference to Table I. indicates that the sizes of the Pitt Lake spawners were similar to those from Morris Creek and Birkenhead, the majority ranging from 25½ to 29½ inches, with an average of 27.7 in the males, and from 23 to 27, with average at 25.4 in the females. These averages are in the case of the males much higher than for five-year males taken from the main run in salt water (26.3); while the average for females agrees exactly with that obtained from five-year females taken in the Vancouver Island traps. It is our belief that practically all of the Pitt Lake run was made up of fish in their fifth year.

The lot proved most homogeneous. The nuclear regions represented a fresh-water growth obviously under highly favourable conditions, though as fingerlings they had failed to attain as large a size as did the fingerlings in Morris Creek. The nuclear rings are bold, firm, well spaced, closely parallel, and regular. The number of rings, as seen in Table II., ranges from thirteen to twenty-one, with mode at seventeen, much lower than Morris Creek. One individual has as few as ten rings; another as many as twenty-three. It is a well-marked race. Figs. 22, 23, and 24 illustrate the nuclear regions of characteristic scales from this region. Like the Morris Creek race, the first year's growth in the sea is large and vigorous.

Table I.—Fraser River Male Sockeyes, examined on their Spawning-beds, 1918, distributed by Lengths and by Locality.

Inches.	Morris Creek.	Harrison Hatchery.	Harrison Rapids.	Pitt Lake Hatchery.	Birkenhead.	Skookumchuck (Lillooet R.).	Hanceville (Chilcotin).	Fish Canyon (Chilcotin).
17½	..	..	1	..	..	..	..	..
18	..	..	..	..	..	2	..	..
18½	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..
19½	..	..	1	..	..	..	..	..
20	..	..	..	..	1	..	..	..
20½	..	..	..	..	..	..	..	..
21	1	..	1	..	..	..	..	1
21½	..	..	..	..	..	..	..	..
22	..	..	1	..	1	..	..	..
22½	1	..	2	1	..	..	..	..
23	..	..	3	1	..	1	..	2
23½	..	..	3	1	..	..	1	2
24	3	1	2	..	3	1	1	2
24½	4	..	2	1	1	3	1	3
25	5	2	4	1	3	7	1	1
25½	14	1	8	3	3	6	..	1
26	16	7	24	7	21	15	..	1
26½	20	1	24	7	5	7	1	..
27	22	8	34	17	9	8	1	..
27½	18	..	11	13	7	3	..	..
28	19	3	8	30	12	2	..	..
28½	10	..	1	8	4	..	..	..
29	8	1	1	16	6	5	..	..
29½	5	..	..	6	4	1	..	..
30	5	..	..	7	1	..	..	..
30½	..	..	..	..	..	..	..	..
31	..	..	..	..	1	..	..	..

Table II.—Fraser River Female Sockeyes examined on their Spawning-beds, 1918, distributed by Lengths and by Locality.

Inches.	Morris Creek.	Harrison Hatchery.	Harrison Rapids.	Pitt Lake Hatchery.	Birkenhead.	Skookumchuck (Lillooet R.).	Hanceville (Chilcotin).	Fish Canyon (Chilcotin).
20	1	..	1	..	..	..	..	..
20½	2	..	..	..	..	..	..	..
21	..	..	..	..	1	1	..	..
21½	..	..	..	..	1	..	..	..
22	5	1	1	..	2	4	1	1
22½	9	..	1	..	4	2	1	1
23	10	1	8	2	12	6	1	4
23½	23	3	8	1	6	1	3	3
24	29	5	20	12	20	12	2	5
24½	40	1	15	9	14	3	1	2
25	41	5	6	24	14	4	1	..
25½	33	1	4	17	7	1	1	..
26	35	1	1	26	9	5	..	..
26½	12	..	..	17	2	1	..	..
27	10	1	..	6	2	2	..	..
27½	3	..	..	..	1	1	..	..
28	2	..	..	..	1	2	..	..
28½	..	..	..	..	..	..	..	..
29	1	..	..	..	1	..	..	..

Table III.—Fraser River Sockeyes examined on their Spawning-beds, 1918, distributed by Number of Nuclear Rings and by Locality.

No. of Rings.	Morris Creek.	Harrison Hatchery.	Pitt Lake Hatchery.	Birkenhead.	Skookumchuck (Lillooet R.).	Fish Canyon (Chilcotin).	Hanceville (Chilcotin).
5	..	..	..	..	1	..	..
6	..	..	..	1	7	..	..
7	..	..	..	6	9	..	1
8	..	..	..	13	20	..	..
9	..	..	..	15	11	3	..
10	..	..	1	10	9	3	..
11	..	..	..	19	11	5	1
12	..	..	..	14	12	7	..
13	..	..	2	8	6	9	4
14	..	..	3	7	1	6	1
15	1	..	6	10	5	4	3
16	5	5	8	3	2	4	..
17	11	6	12	5	..	8	1
18	20	3	11	..	3	4	..
19	21	7	6	1	..	2	1
20	27	6	5	1	1	3	..
21	22	4	3	1	..	1	..
22	14	5	..	..	..	..	..
23	10	3	1	..	..	..	..
24	9	..	..	..	..	..	..
25	6	1	..	..	..	..	..
26	3	..	..	..	..	..	..
27	2	..	..	..	..	..	..
28	2	..	..	..	..	..	..

The Chilcotin River.—It was with difficulty that any material was obtained from this district. Mr. Babcock and the writer spent August 21st to 23rd at Hanceville and Alexis Creek. One specimen only was seen at Alexis Creek, while at Hanceville, although dipping was constantly in progress, only eighteen individuals were taken. At Fish Canyon, near the mouth of the Chilcotin, on August 24th and 25th, thirty freshly caught sockeyes were examined, and portions of the skin containing scales were dissected off from sixty-two fish found drying on the racks. In the case of the dried specimens we could obtain no reliable measurements and no record of sex. But the history of the individuals is, of course, found equally recorded on the scales. Such material, in default of better, may be availed of for the present purpose.

A cursory examination of the Chilcotin material would be sufficient to demonstrate that it is totally distinct from any of the spawning runs investigated in the part of the Fraser River basin which lies below the canyon. No single specimen from the Chilcotin agrees with the Harrison Rapids colony in having migrated to salt water in its first year. All had spent at least one year in the fresh-water lakes before descending to the sea. Furthermore, a considerable proportion of the Chilcotin fish (from 35 to 40 per cent. of the whole) had spent two full years as fingerlings in their lake. This is a very significant fact, in view of the almost total absence of representatives of this group from the Harrison watershed and the Pitt during the season of 1918. Obviously there is wide variation from year to year in the extent to which fingerlings in the same spawning area will tarry in the lake for a second year. Thus, as has been shown in our report for 1916 (page 51), the two-years-in-lake type was abundantly represented in the Birkenhead, where they constituted 10 per cent. of the run. But only one specimen was found in 1918 among 288 examples from Skookumchuck and Pemberton.

Only 6 per cent. two-years-in-lake fish were found in the Chilcotin in 1916. It seems evident that the occurrence of this type in some abundance is more probable within certain spawning areas than in others; but extensive fluctuations occur in successive years. From such evidence as is before us, it would seem that in 1918 the members of this group were exclusively bound for the Chilcotin, and perhaps other spawning-grounds above the Yale Canyon. Their distribution

in the main run becomes then a matter of special interest. Referring to our Esquimalt records, we find this class sparingly represented during the early part of June, but the number increasing during the month, until on June 28th it constituted 14 per cent. of the whole. Up to this point the history of 1918 exactly parallels that of 1916. On July 2nd they constituted 12 per cent.; July 10th, 3.5 per cent.; July 14th, 9 per cent.; July 18th, 9 per cent.; July 21st, 11 per cent.; July 25th, 11 per cent.; July 29th, 13 per cent.; August 2nd, 5.5 per cent.; August 4th, 5.5 per cent.; August 8th, 5.5 per cent.; August 11th, 2 per cent.; and subsequent dates occasionally with one specimen, but usually without any. The striking difference between 1918 and 1916, as regards the run of the two-years-in-lake type, lies in the heavier early run in 1918 and the almost total disappearance of these forms in the latter part of August. On August 10th, 1916, 10 per cent. and on August 27th 10 per cent. of the run belonged to this class. It seems highly probable that the numerous late-running individuals in 1916 were bound to streams below the canyon.

The material obtained at Fish Canyon did not differ in any respect from that obtained higher up-stream at Hanceville. The nuclear areas of the scales are characteristically marked with slender rings, not greatly crowded, nor widely spaced. The rings are fairly regular and in general parallel, but the individual rings are frequently broken and interrupted. Figs. 14 to 20 present characteristic centres of Chilcotin scales, the majority of these from the two-years-in-lake form.

The first year's growth in the sea usually averages small, with the scale-rings often crowded and irregularly spaced, indicating partial checks in the middle of the growing season. Variations are found in this regard, as is always the case, but the general picture is of a single spawning type, displaying not more than the usual amount of variation. Two forms can be roughly distinguished, one with large, the other with small nuclear regions, and these two exist among those individuals that spent two years in the lake as well as among those that migrated seawards in their second spring. No other differences have been detected between the two groups. Those with the larger type nucleus may have been the first to hatch. Intermediate individuals are found.

It was impossible to determine the age in the majority of the specimens. In thirty-three out of a total of 108 the scale was complete at some point on the margin, and made it possible to ascertain in each case that the fish when captured was in its third year since entering the sea. Those of the one-year-in-lake type were all in their fourth year; those of the two-years-in-lake type were in their fifth year. Both types had spent an equal period on the sea-feeding grounds and had reached essentially the same size. A comparison of length-frequencies of Chilcotin fish (Table I.) with those of Pitt Lake, Morris Creek, and the Birkenhead will show the much smaller range in size of the Chilcotin material. We failed to find evidence of five-year fish (one-year-in-lake type) in the Chilcotin, either in 1916 or in 1918; or of six-year fish (two-years-in-lake type), although numerous examples of these six-year fish are known to have entered the mouth of the river in June and July.

The Quesnel River.—No material was obtained from the Quesnel River. Mr. Babcock and the writer visited the dam and fishway at the outlet of Quesnel Lake on September 3rd and 4th. No salmon had been observed to enter the fishway, and only two or three which we did not secure were seen in the pool at the foot of the race. No run was reported at any later date.

Specimens were secured, mainly from drying-racks, at Chimney Creek Bridge and at Soda Creek, points on the main river between the mouths of the Chilcotin and the Quesnel. It might be assumed with some justice that the majority, if not all, of these fish were headed for the Quesnel. Along the river between Quesnel and Fort George no success appeared to attend fishing at any point. Here and there we could learn of the capture of a few strays, but that was all. Yet it is hazardous to adopt conclusions based on evidence of this nature. Some proportion of the Soda Creek and Chimney Creek fish were undoubtedly bound up-river beyond the Quesnel. What the relative numbers were it is impossible to estimate. The same kind of evidence that would convince us no fish were running in the upper river can also be adduced to demonstrate that none entered the Quesnel.

The material secured at Chimney Creek Bridge and at Soda Creek was clearly different from that obtained in the Chilcotin. For one point of distinction, there were few individuals of the two-years-in-lake type. Out of a total of seventy-one specimens, only five, or 7 per cent., were of this class, which constituted 35 per cent. of the Chilcotin fish. This abrupt change from

the mouth of the Chilcotin in the few miles to Soda Creek could have only one meaning. A distinct body of fish, developed from fry which had been hatched in the Chilcotin, had entered that river. Other minor differences marked the nuclear portions of the scales from fish taken above the mouth of the Chilcotin—differences which hardly lend themselves to description, as they appear in the ever-varying material, but nevertheless in a composite image are found to have a certain distinctness and an unquestioned significance. The nuclear rings are on the average more closely crowded, while the number of rings remains about the same, ranging widely from seven to twenty-one, with the mode at ten. The first year's growth in the sea is small, and the individuals are all of those sizes which characterize Fraser River sockeyes that have spent three years at sea. The condition of the scales permitted us to ascertain the age of but one specimen, a four-year fish, but we entertain no doubt that all the individuals observed had spent three years at sea, and were either in their fourth or fifth year, depending on whether as fingerlings they had remained one year or two years in fresh water. Fig. 21 presents for comparison the centre of the scale of a Soda Creek specimen.

Fraser River Canyon above Yale.—Fifty specimens were obtained from natives dipping in the canyon and above, as far as Lytton. Inasmuch as it is supposed no sockeyes entered the Thompson in 1918, and the Seton-Anderson section was wholly bare of spawning-fish, it would be natural to assume that sockeyes captured in the canyon above Yale were all bound for the Chilcotin and the Quesnel, and would wholly resemble the fish captured at Fish Canyon and Chimney Creek. Nothing could be farther from the truth. The Yale Canyon fish averaged much larger than the up-river fish, and contained a considerable proportion of five-year individuals, of which not one was detected above. Apparently some 30 per cent. of the fish dipped in the canyon were five years old, a much larger percentage than was at any part of the run entering the mouth of the river. The destination of these five-year sockeyes is a question of much importance. The only direct evidence we have is derived from two specimens, the only material obtained from the Thompson River—one taken two miles east of Lytton on the Thompson; the other at Thompson Siding, nine miles east of Lytton. Both of these are five years old, one 24 the other 26 inches long, and both females. Only four of the fifty are of the two-years-in-lake type, so we could not be dealing to any considerable extent with Chilcotin material. Furthermore, many of the nuclear regions of the scales are of the robust type, with strong, bold, parallel ridges, quite different from the delicate slender-ringed nuclei of the upper river. Figs. 25 to 28 illustrate certain of the types of scales characterizing the sockeyes taken in Yale Canyon and above, while Fig. 29 is from the Thompson.

We can apparently not escape the conclusion that a large proportion of these canyon fish, taken during the month of August, were bound up the Thompson River. Certainly they were *not* bound for the Chilcotin or the upper district. Although few in number, they were concentrated in the canyon, but when they reached the quiet waters above the canyon, and afterwards scattered over the immense Shuswap-Adams district, they were wholly lost to sight. If this inference is correct, it gives us the first glimpse of the Thompson race or races. The suggestion that these fish, like those spawning below the canyon, may in considerable numbers attain five years of age is an interesting one, and must be taken into account in all discussions of the four-year cycle and the striking variation in the proportion of the age-groups in the Fraser River.

Bridge River.—No material was obtained from the stretch of the Fraser between the mouth of the Thompson at Lytton and the outlet to Seton Lake at Lillooet. Above Lillooet, at Bridge River, fifty specimens were obtained from August 21st to September 8th, and proved on examination to contain a mixture of the type found in the Chilcotin at Fish Canyon, together with that secured above the Chilcotin in the main Fraser at Chimney Creek Bridge and at Soda Creek. The Chilcotin type predominated. Twenty-six per cent. were constituted of two-years-in-lake fish. The sizes ran low and the entire assemblage was markedly different from that taken at the same period and earlier in the month of August in the Yale Canyon. One specimen, a male 27 inches long, was in its fifth year, but all the others were of smaller size and apparently four-year fish. The nuclear rings of those of the one-year-in-lake form ranged from twelve to twenty-one, the smaller sizes predominating, and largely concentrated between thirteen and seventeen; the mode at sixteen. Those of the two-years-in-lake type have the rings of the first year ranging from six to eleven; those of the second year from twelve to twenty.

II. THE FRASER RUN OF 1918.

In our report for 1916 we remarked: "The run of sockeye salmon to the Fraser River in 1916 was the poorest known." In 1917 we were obliged to record the disappearance of the big year of the cycle from Fraser River runs, with no prospect of its recovery. And in 1918 the run reaches still lower dimensions than in 1916, the total catch on Puget Sound being 50,617 cases and in Canadian waters 20,955 cases, a total of 71,572 cases. This is but six-tenths the catch of 1916, the poorest previous year.

The brood-years for 1918 were 1913 for the five-year fish and 1914 for those in their fourth year, the four-year fish largely predominating, as is customary in the Fraser River. 1913 was the big year of that cycle, but big years are now known to owe their magnitude to four-year fish hatched in the upper waters of the Fraser, in tributaries which produce few or no five-year fish. The tributaries of the Fraser which are responsible for five-year fish lie below the Yale Canyon, with the possible exception of the Thompson River, and have never experienced large increases in the size of the run during the big years of the cycle. We would have no reason to expect, therefore, any unusual influx of five-year fish in 1918 because of its relation to 1913. On the other hand, the 1913 run to the Lillooet Lake section, which supports the Pemberton Hatchery on the Birkenhead, the most important spawning stream of the Harrison-Lillooet section of the river, was distinctly poorer than in any big year since the hatchery had been established there. The history of 1913 gave no grounds for hope of any large number of five-year fish in 1918.

The four-year fish were hatched from the 1914 brood stock, which would be considered of more than average size for an off-year if we relied on the figures for the commercial returns (555,557 cases). On inspecting the reports from the spawning-grounds presented by Mr. Babcock for 1914, we find, however, that serious obstructions in the canyon above Yale prevented the ascent of the salmon during the greater part of August, and hampered them greatly at other portions of the run. The result was what might have been anticipated. The numbers that reached the up-river spawning-grounds were everywhere greatly reduced. Fewer sockeye reached the Chilcotin than during any other recorded year. The run at Quesnel Lake was one of the poorest since the fishway was built in 1903, the total number that entered the lake being too small to make any noticeable showing there. Only a few hundred reached the Seton-Anderson Lake section, and the run to the Shuswap-Adams District was distinctly light. There was a fair run to Lillooet Lake and a rather small run to the Harrison.

This review of the situation is given to show how hazardous it is to predict future runs solely on the basis of the number of cases packed during the brood-years. This cannot be depended on to give reliable data on the number of fish that will succeed in spawning. A careful study of the conditions described on the spawning-beds of the Fraser in 1913 and 1914 by Mr. Babcock would have prepared us for a decidedly limited run in 1918, though perhaps it would not have foreshadowed the magnitude of the disaster.

Age-groups.—In spite of the phenomenally small size of the run, the number of five-year fish shows no marked increase above the normal, although in other years of reduced run it has frequently shown such increase. Taking into consideration those sockeyes only which remained one year in the lake before passing to sea, we find the average percentage of five-year fish in the run to have been 23 per cent., varying on different days of the run from 5 to 59 per cent. No orderly sequence was observed, although in general the heavier percentages were found in June and July. Striking changes in the relative proportions of age-groups in successive years accompanies violent alternations of good and bad years. In such cases we find the poor years in such a series are signalized on the Fraser by a high percentage of five-year fish. But when the runs have declined almost uniformly to a low level, as seems now to be the case, the age-groups regain their normal relations and remain about the same from year to year.

Succession of Types in the Run.—As in previous years, it was obvious in examining the takes of different dates in orderly sequence that changes were constantly occurring in the constitution of the run. On July 2nd and 10th, for example, two distinct types could be recognized, one with a small nuclear region, containing most frequently eight to fourteen rings, usually with a band of intermediate rings outside it, and a small first year in the sea. The nuclear rings were fine, crowded, and more or less broken, and numerous five-year fish were included in this series. The characteristics here given are so closely those of the Lillooet-Birkenhead race as to raise a presumption that the fish of this type were bound to that portion of the Fraser watershed.

The second type was marked by the large size of the nucleus, containing sixteen to twenty-two rings, and without distinct band of intermediates surrounding it. The nuclear rings are boldly drawn and strong, well spaced, and not interrupted. The first year's growth in the sea is not reduced, with more or less crowded, irregularly spaced rings, as in the preceding type, and very few are in their fifth year. This second type apparently disappears abruptly about the middle of July and is replaced by several partially recognizable strains, which, together with type number one, form a very mixed assemblage. Figs. 30 to 34 illustrate some of the different forms which appear in this run.

Tables IV. to XI. give the succession of sizes appearing on a series of dates, and indicate that the average size increases during the advance of the season, largely by the disappearance of the smaller individuals included in the early part of the run. Taking into consideration only the predominating class in the Fraser, which after hatching spends one full year (fifteen months) in the lake, the average sizes for the 1918 run are as follows:—

	Length, Inches.	Weight, Lb.
Four-year males	24.9	6.5
Four-year females	23.8	5.7
Five-year males	26.3	7.5
Five-year females	25.4	6.7

From the above it appears the conditions on the feeding-grounds at sea were normal and an average growth was effected. Compare with Table XI., page 35 of Paper No. 3 (1915), of this series.

Table IV.—Fraser River Sockeyes, Four-year Males, Esquimalt, 1918, distributed by Lengths and Dates of Capture.

Inches.	June 17.	June 20.	June 28.	July 2.	July 10.	July 14.	July 18.	July 21.	July 25.	July 29.	Aug. 2.	Aug. 4.	Aug. 8.	Aug. 11.	Aug. 13.	Aug. 16.	Aug. 23.	Aug. 26.
19½	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20½	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21½	...	...	...	1	...	2	...	...	...	...	...	...	...	...	...	...	...	...
22	...	3	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	4	...	1	1	...	...	3	...	1	...	...	...	...	...	...	...	...
23½	...	2	1	1	1	2	2	1	4	3	1	1	...	2	...	1	...	...
24	1	5	1	2	3	5	4	3	4	...	...	1	1	3	...	...	...	2
24½	2	...	...	2	1	...	4	2	4	2	1	6	3	6	4	8	...	...
25	...	1	3	2	4	3	4	3	1	1	1	5	2	3	3	1	1	3
25½	...	...	2	2	7	1	3	1	4	3	4	6	10	7	...	12	1	2
26	...	...	...	5	6	2	...	1	...	1	1	4	5	3	5	3	1	...
26½	...	...	...	...	1	1	...	...	...	1	2	...	1	1	...	2	...	...
27	...	...	...	1	2	...	...	2	2	...	...	...	...	...	...	...	...	...
Totals	5	18	7	19	26	16	17	16	19	12	10	23	22	25	12	27	3	7

Table V.—Fraser River Sockeyes, Four-year Females, Esquimalt, 1918, distributed by Lengths and Dates of Capture.

Inches.	June 17.	June 20.	June 28.	July 2.	July 10.	July 14.	July 18.	July 21.	July 25.	July 29.	Aug. 2.	Aug. 4.	Aug. 8.	Aug. 11.	Aug. 13.	Aug. 16.	Aug. 23.	Aug. 26.	Sept. 3.
20	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21½	1	2	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...
22	...	6	1	1	...	2	1	2	...	...	...	...	...	...	...	...	...	...	...
22½	2	3	1	2	1	...	2	...	...	4	...	...	2	3	...	...	...	...	...
23	...	5	4	1	2	1	4	3	2	2	...	3	...	...	...	1	...	...	...
23½	2	1	2	...	1	1	1	7	6	7	4	8	6	3	...	6	...	2	...
24	1	4	2	2	2	7	4	3	4	2	...	1	2	4	4	5	...	...	...
24½	1	...	1	2	4	1	2	5	3	8	2	6	6	4	3	5	...	...	1
25	...	...	...	2	4	5	...	...	1	3	1	2	1	1	2	...	1	1	...
25½	...	...	1	...	1	2	...	...	1	1	...	1	3	1	...	...	...	...	...
26	...	...	...	...	1	...	1	1	...	...	1	...	...	...	...	...	...	...	...
26½	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...
27½	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Totals	10	21	12	12	16	19	15	21	17	28	9	21	20	17	9	18	1	3	1

Table VI.—Fraser River Sockeyes, Five-year Males, Esquimalt, 1918, distributed by Lengths and Dates of Capture.

Inches.	June 17.	June 20.	June 28.	July 2.	July 10.	July 14.	July 18.	July 21.	July 25.	July 29.	Aug. 2.	Aug. 4.	Aug. 8.	Aug. 11.	Aug. 13.	Aug. 16.	Aug. 23.	Aug. 26.
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23½	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
24½	...	...	...	...	...	1	1	1	...	...	...	1	...	...	...	...	...	...
25	1	2	...	1	...	1	1	...	...	...	1	...	...	...	...	...	...	1
25½	...	1	4	1	1	...	1	1	...	...	...	3	1	...	...	1	...	...
26	1	4	3	1	...	3	...	1	...	...	...	...	...	...	...	...	...	...
26½	1	...	2	...	1	1	3	...	...	...	...	1	...	1	...	...	...	1
27	...	3	2	2	2	3	1	1	1	...	...	1	...	...	...	1	...	...
27½	...	...	2	2	...	...	2	...	3	...	...	1	3	...	...	...	...	...
28	...	...	...	1	...	...	...	...	2	...	...	...	...	...	1	...	...	...
28½	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Totals	4	11	13	8	4	11	9	4	6	...	1	7	4	2	1	2	...	2

Table VII.—Fraser River Sockeyes, Five-year Females, Esquimalt, 1918, distributed by Lengths and Dates of Capture.

Inches.	June 17.	June 20.	June 28.	July 2.	July 10.	July 14.	July 18.	July 21.	July 25.	July 29.	Aug. 2.	Aug. 4.	Aug. 8.	Aug. 11.	Aug. 13.	Aug. 16.	Aug. 23.	Aug. 26.
22	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23½	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
24	...	1	2	...	...	...	2	1	...	...	...	...	...	...	...	...	1	...
24½	...	1	3	...	...	...	...	1	1	...	2	...	...	...	...	...	1	...
25	...	...	2	1	1	...	...	1	...	...	...	2	...	...	1	...	...	...
25½	...	2	2	2	1	...	...	...	1	...	2	1	2	2	...	1	1	1
26	...	1	2	...	3	...	1	2	...	...	...	...	...	...	...	...	...	...
26½	1	...	3	1	...	1	...	...	...	...	...	...	1	1	...	...	...	...
27	...	...	1	...	2	...	...	...	...	2	...	...	...	...	...	...	...	...
27½	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Totals	2	5	15	5	7	1	4	6	2	2	4	3	3	3	1	1	3	1

Table VIII.—Fraser River Sockeyes, Four-year Males, Esquimalt, 1918, distributed by Weights and Dates of Capture.

Pounds.	June 17.	June 20.	June 28.	July 2.	July 10.	July 14.	July 18.	July 21.	July 25.	July 29.	Aug. 2.	Aug. 4.	Aug. 8.	Aug. 11.	Aug. 13.	Aug. 16.	Aug. 23.	Aug. 26.
3	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3½	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	1	...	2	...	1	...	...	...	...	...	...	...	...	...	...	...	...
4½	1	4	...	2	...	1	...	...	...	...	...	...	...	...	...	...	...	...
5	1	8	...	...	...	1	...	1	...	1	...	1	...	1	...	...	...	...
5½	1	1	5	4	2	...	6	2	4	2	...	2	1	2	...	2	1	1
6	...	1	...	1	2	5	...	4	4	1	...	1	1	4	3	...	1	1
6½	...	1	1	4	5	3	6	3	5	5	3	8	9	4	3	9	1	2
7	...	...	1	4	5	2	1	1	4	1	...	4	1	5	3	4	...	1
7½	...	...	...	2	7	2	4	2	...	1	5	5	8	6	1	10	...	2
8	...	...	...	...	1	...	...	2	...	...	2	2	...	3	1	...	1	...
8½	...	...	...	...	3	1	...	1	1	1	...	...	2	...	1	2	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9½	...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...
Totals	5	18	7	19	26	16	17	16	19	12	10	23	22	25	12	27	3	7

Table IX.—Fraser River Sockeyes, Four-year Females, Esquimalt, 1918, distributed by Weights and Dates of Capture.

Pounds.	June 17.	June 20.	June 28.	July 2.	July 10.	July 14.	July 18.	July 21.	July 25.	July 29.	Aug. 2.	Aug. 4.	Aug. 8.	Aug. 11.	Aug. 13.	Aug. 16.	Aug. 23.	Aug. 26.	Sept. 3.
3	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3½	1	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	6	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4½	5	4	4	1	1	...	5	2	3	3	1	1	2	...	...	1	...	...	...
5	2	7	1	3	1	1	2	5	...	4	1	...	1	1	...	...	...	...	...
5½	...	1	6	1	2	3	4	3	6	5	1	10	4	8	1	7	...	...	...
6	...	2	...	3	1	4	6	8	3	7	1	6	4	2	2	5	...	2	1
6½	...	...	1	...	7	2	...	2	5	7	3	3	7	4	4	5	1	...	...
7	1	...	...	2	1	5	...	...	...	2	...	1	...	1	2	...	...	1	...
7½	...	...	...	...	3	2	...	1	...	...	1	...	2	...	...	...	...	...	...
8	...	...	...	...	...	2	...	...	...	...	...	...	...	1	...	...	...	...	...
8½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...
9½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals	10	21	12	12	16	19	15	21	17	28	9	21	20	17	9	18	1	3	6

Table X.—Fraser River Sockeyes, Five-year Males, Esquimalt, 1918, distributed by Weights and Dates of Capture.

Pounds.	June 17.	June 20.	June 28.	July 2.	July 10.	July 14.	July 18.	July 21.	July 25.	July 29.	Aug. 2.	Aug. 4.	Aug. 8.	Aug. 11.	Aug. 13.	Aug. 16.	Aug. 23.	Aug. 26.
4½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	1	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
5½	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
6	...	2	...	...	...	...	2	...	...	...	...	2	...	...	...	...	...	...
6½	1	1	6	3	...	1	...	1	...	...	...	1	1	...	...	...	...	1
7	...	2	1	2	...	1	1	1	...	...	...	1	...	...	...	...	...	...
7½	1	3	4	1	2	1	1	1	...	...	1	...	1	1	...	1	...	...
8	...	3	1	2	1	1	2	...	1	...	...	2	...	...	...	...	...	1
8½	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	1	...	...
9	...	...	1	...	...	2	1	...	2	...	...	...	...	...	...	...	...	...
9½	...	...	...	...	...	1	1	...	3	...	...	1	2	...	1	...	...	...
10	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
10½	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11½	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Totals	4	11	13	8	4	11	9	4	6	...	1	7	4	2	1	2	...	2

Table XI.—Fraser River Sockeyes, Five-year Females, Esquimalt, 1918, distributed by Weights and Dates of Capture.

Pounds.	June 17.	June 20.	June 28.	July 2.	July 10.	July 14.	July 18.	July 21.	July 25.	July 29.	Aug. 2.	Aug. 4.	Aug. 8.	Aug. 11.	Aug. 13.	Aug. 16.	Aug. 23.	Aug. 26.
4½	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5½	1	1	4	...	...	...	1	1	...	...	...	...	...	...	...	...	2	...
6	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
6½	...	2	6	4	3	...	2	2	2	...	2	2	...	1	1	...	...	...
7	...	1	1	...	1	...	1	...	...	...	1	...	1	...	...	...	...	...
7½	1	...	3	...	2	...	...	2	...	...	1	...	2	2	...	...	...	1
8	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	1	...	...
8½	...	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...
9½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
10½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11½	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals	2	5	15	5	7	1	4	6	2	2	4	3	3	3	1	1	3	1

III. THE RIVERS INLET SOCKEYE RUN OF 1918.

The Rivers Inlet sockeye run of 1918 was the third very poor run in succession. Were it not for the exceptionally favourable showing in 1915 (130,350 cases), giving evidence of extensive fluctuations for which we cannot account, the present situation would take on a grave aspect. With the spawning-beds in Owikeno Lake in unsatisfactory condition, close attention should be paid this fishing district in the following years.

The run of 1918 had a smaller percentage of five-year fish than in any previous year since the very unsatisfactory season of 1913. Rivers Inlet is predominately a five-year stream, and in general (exceptions can be noted) has shown the largest proportions of five-year fish during the most successful seasons. The five-year fish of 1918 were derived from 1913, when the fish, in addition to small numbers, were small in size for the various age-groups. But in 1918 they were far smaller, well below the average for this river both in length and in weight for all groups. The season must be considered a highly exceptional one. The males were much more numerous than the females compared with previous years, and the five-year fish pursued the very opposite course to that which they followed in 1916 and 1917. In these two years they appeared most abundantly in the early days of the run and gradually decreased as the season advanced. This is the customary method with five-year fish, not only in Rivers Inlet, but in other streams as well. But in 1918 the Rivers Inlet five-year-olds were almost wholly lacking at the beginning of the run, when on June 27th they constituted only 7 per cent. of the catch. From this date they increased regularly until July 19th, when they made 69 per cent. of the day's capture, and then maintained approximately that percentage for the remainder of the season. The reasons for such complete reversals of habit in a highly exceptional year cannot be conjectured at present.

Table XII.—Percentages of Four- and Five-year Rivers Inlet Sockeyes in Runs from 1912 to 1918, with the Broods from which they were derived.

Run of the Year.	Percentage. Four and Five Years old.	Brood-year from which derived.
1912 (112,884 cases)	5 yrs. 79% 4 yrs. 21%	1907 (87,874 cases). 1908 (64,652 cases).
1913 (61,745 cases)	5 yrs. 20% 4 yrs. 80%	1909 (89,027 cases).
1914 (89,890 cases)	5 yrs. 65% 4 yrs. 35%	1910 (126,921 cases).
1915 (130,350 cases)	5 yrs. 87% 4 yrs. 13%	1911 (88,763 cases).
1916 (44,936 cases)	5 yrs. 76% 4 yrs. 24%	1912 (112,884 cases).
1917 (61,195 cases)	5 yrs. 67% 4 yrs. 33%	1913 (61,745 cases).
1918 (53,401 cases)	5 yrs. 57% 4 yrs. 43%	1914 (89,890 cases).

Table XIII.—Percentages of Five-year Rivers Inlet Sockeyes occurring at Different Dates in the 1918 Run.

Dates, 1918.	Percentages of Five-year Fish.	Number of Specimens examined.
June 27	7	75
„ 29	19	75
July 2	25	75
„ 4	32	75
„ 10	37	75
„ 12	64	75
„ 16	59	75
„ 19	69	75
„ 23	44	70
„ 26	59	75
„ 30	54	70

Table XIV.—Percentages of Males and Females in Rivers Inlet Sockeyes occurring on Different Dates, Season of 1918.

	June 27.	June 29.	July 2.	July 4.	July 10.	July 12.	July 16.	July 19.	July 23.	July 26.	July 30.
Four-year males	93	85	91	98	81	59	77	78	51	51	48
Four-year females	7	15	9	2	19	41	23	22	49	49	42
Five-year males	60	57	63	92	43	50	39	48	58	34	43
Five-year females	40	43	37	8	57	50	61	52	42	66	67

Average percentages—
- Four-year males 74
- Four-year females 26
- Five-year males 53
- Five-year females 47

Average total males throughout season ..... 66 per cent.
Average total females throughout season ..... 34 „

Table XV.—Rivers Inlet Sockeye, Run of 1918, grouped by Length, Age, and Sex.

Length in Inches.	Number of Individuals.			
	Four Years old.		Five Years old.	
	Males.	Females.	Males.	Females.
19	1	..	..	..
19½	1	..	..	..
20	6	..	..	..
20½	10	1	..	..
21	50	4	..	..
21½	55	11	1	..
22	69	23	4	1
22½	49	25	4	3
23	35	9	8	17
23½	26	11	23	13
24	31	8	20	39
24½	15	1	14	35
25	7	2	21	25
25½	..	..	17	20
26	..	1	28	16
26½	..	..	15	4
27	..	..	11	2
27½	..	..	4	..
28	..	..	1	..
Totals	355	96	171	175
Average length in inches	22.3	22.5	24.9	24.5

Table XVI.—Rivers Inlet Sockeye, Run of 1918, grouped by Weight, Age, and Sex.

Weight in Pounds.	Number of Individuals.			
	Four Years old.		Five Years old.	
	Males.	Females.	Males.	Females.
3	2	..	..	..
3½	7	..	..	..
4	42	3	..	..
4½	117	24	2	2
5	77	34	11	20
5½	51	20	26	22
6	30	9	24	46
6½	20	5	22	29
7	8	..	29	26
7½	1	..	21	20
8	..	1	15	6
8½	..	..	12	2
9	..	..	5	1
9½	..	..	3	1
10	..	..	1	..
Totals	355	96	171	175
Average weight in pounds	4.9	5.1	6.7	6.3

IV. SKEENA RIVER SOCKEYE RUN OF 1918.

(1.) General Characteristics and the Age-groups.

The Skeena River sockeye-pack for 1918 consisted of 123,322 cases, and ranks among the best half-dozen years in the history of the industry. Coming as it does after two phenomenally poor years, it gives grounds for hope that the Skeena may not as yet be suffering the results of overfishing. Evidences of the decline of a run, with standardized fishing methods, are, however, generally of slow and irregular approach. The returns from this river should be most carefully scrutinized.

The necessity for this is all the more evident for the reason that some important factor which must be largely concerned in determining the success or failure of the runs remains unknown to us. Attention has been repeatedly drawn to the total lack of relation between the run of any year and the apparent size of the runs four and five years before. The year 1918 presents a striking example of this lack of correlation. Its brood-years were 1913 and 1914, and as its five-year fish constituted 59 per cent. of the total run of 1918, the year 1913 was relatively the most important. But 1913 was apparently the very poorest year the Skeena has ever experienced. The four-year fish derived from the 1913 run constituted only 38 per cent. of the run of 1917, which was but little better than 1913. There seemed no reason to anticipate that 1913 would deliver five-year fish in 1918 far in excess of its entire yield of both four- and five-year fish.

The nature of the unknown factor must be at present wholly a matter for conjecture. We have called attention previously to the effect of boisterous weather on the commercial success of a season. A stormy summer is popularly supposed largely to diminish the proportion of salmon captured. The number of cases packed during such a season might indicate a poor run, whereas the run may have been above the average, and the escape to the spawning-beds unusually large. An attempt to correlate size of pack with weather conditions has not been made. It is possible that weather may exert a directly favourable or unfavourable influence on the size of the run in any year, in addition to its effect on fishing operations. This also is a matter inviting careful investigation.

During previous years we have observed an extensive variation in the relative abundance of the two-years-in-lake group. It has varied from 7 per cent. in 1914 to 27 per cent. in 1916, but in two of the four years in which this proportion has been determined it has been 14 and 15 per cent. We have observed in other rivers a wide disparity in this regard between successive years. Evidently, at times, a much larger percentage of the yearlings fail to migrate in their second spring than is usually the case. We have no clue to the significance of this change of habit. It is perhaps to be sought in fluctuating conditions which in certain seasons are less favourable to vigorous growth of the fingerlings than in other seasons. We have previously called attention to the fact that the larger sizes of yearlings migrate at the end of their first year, while the smaller sizes more frequently remain behind for additional growth. If a racial habit has been formed in a given river favouring migration seawards when a certain average stature has been attained, a much larger proportion of individuals may fail to reach it in one year than in another.

In 1918 the Skeena River run contained what appears to be a fair average number of adults that had when fingerlings spent two years in fresh water. Fifteen per cent. of the run belonged to this class. As shown in Table XVIII., 60 per cent. of these returned at the age of five and 40 per cent. at the age of six. A tendency appears for the members of this group to run into the river in larger numbers during the early part of the season, although this tendency is not so strongly marked as in the case of the five-year fish that as fingerlings spent only one year in the lake. As shown in the table, the individuals belonging to the latter group become proportionally less abundant during the latter half of July, while the four-year fish that have spent only one year in fresh water become more abundant.

(2.) Relative Numbers of Males and Females.

A well-marked tendency for the males to precede the females was shown in 1918 in the Skeena, and is evidenced by Table XX., giving the proportions of the sexes in both four-year and five-year fish, taken at intervals of three or four days throughout the run. During the dates in June males were in excess of females generally in both groups, largely in excess in

the younger group, less so in the five-year contingent. In both groups, as the season progresses, there is an obvious increase in the number of females at the expense of the males. During the latter half of July the five-year females are greatly predominating, and the four-year females are nearly as abundant as the males of their class. Taking into consideration all the groups present in the run, the one-year-in-lake and the two-years-in-lake groups, of all ages, we find the males notably exceeding the females and constituting 57 per cent. of the entire run.

Considering the run as a unit and ignoring the fluctuations in its constitution from its origin to its close, we find the proportions of the sexes in the different groups, brought into comparison with previous years, presented in Table XXI. The close correspondence in a series of years is most striking, as is also the fact that the proportions of the sexes in 1918 represents in each of the groups the average for all the years of which we have a record. We note again that males predominate in both groups of the two-years-in-lake series. The five-year members have a slightly higher percentage of males than the six-year class, but in both classes the males are constantly in excess. It is not clear why the two years spent in fresh water in their early history should have influenced them in this manner. We should have expected males to predominate in the five-year class, while females would be equally in excess with the six-year-olds.

(3.) Lengths and Weights.

The following tables indicate that the size of Skeena River sockeyes in 1918 was fully up to the average observed over a series of years. The conditions at sea then had been favourable, and no adverse weather conditions had stunted growth during the late winter and early spring months of the spawning year. We again call attention to the comparatively unreliable averages for fish of the two-years-in-lake group, due to the small size of these groups. The weights for the year agree as closely as do the lengths. Comparing 1918 with 1915, we find the greatest difference in the average weights for the various classes is two-tenths of a pound; while the greatest difference in the average lengths equals two-tenths of an inch.

Table XVII.—Percentages of Four- and Five-year Skeena River Sockeyes that spent One Year in Lake, in Runs of Successive Years.

Run of the Year.	Percentage. Four and Five Years old.	Brood-year from which derived.
1912 (92,498 cases)	5 yrs. 43% 4 yrs. 57%	1907 (108,413 cases). 1908 (139,846 cases).
1913 (52,927 cases)	5 yrs. 50% 4 yrs. 50%	1909 (87,901 cases).
1914 (130,166 cases)	5 yrs. 75% 4 yrs. 25%	1910 (187,246 cases).
1915 (116,553 cases)	5 yrs. 64% 4 yrs. 36%	1911 (131,066 cases).
1916 (60,923 cases)	5 yrs. 60% 4 yrs. 40%	1912 (92,498 cases).
1917 (65,760 cases)	5 yrs. 62% 4 yrs. 38%	1913 (52,927 cases).
1918 (123,322 cases)	5 yrs. 59% 4 yrs. 41%	1914 (130,166 cases).

Table XVIII.—Percentages of Different Age-groups, Skeena River Sockeyes, found to constitute the Run on a Succession of Dates, Season of 1918.

Dates, 1918.	One Year in Lake.		Two Years in Lake.	
	Four Years old.	Five Years old.	Five Years old.	Six Years old.
June 22	27	33	13	27
„ 25	33	55	6	6
„ 28	30	53	11	6
July 1	27	48	11	14
„ 4	59	23	16	2
„ 8	46	48	3	3
„ 12	42	38	12	8
„ 15	44	39	14	3
„ 19	67	26	5	2
„ 22	76	13	11	..
„ 27	83	13	4	..
„ 30	82	16	2	..

Table XIX.—Relative Numbers in One-year-in-lake and Two-years-in-lake Groups, Skeena River Sockeyes, 1918, on a Succession of Dates.

Dates.	One Year in Lake.	Two Years in Lake.
June 22	60	40
„ 25	88	12
„ 28	83	17
July 1	75	25
„ 4	82	18
„ 8	94	6
„ 12	80	20
„ 15	83	17
„ 19	93	7
„ 22	89	11
„ 27	96	4
„ 30	98	2

Table XX.—Percentages of Males and Females, One-year-in-lake Group, Skeena River Sockeyes, 1918, on a Succession of Dates.

Dates.	Four Years.		Five Years.	
	Males.	Females.	Males.	Females.
June 22	61	39	61	39
„ 25	74	26	59	41
„ 28	94	6	46	54
July 1	82	18	60	40
„ 4	59	41	53	47
„ 8	85	15	46	54
„ 12	67	33	46	54
„ 15	62	38	30	70
„ 19	63	37	12	88
„ 22	56	44	17	83
„ 27	44	56	33	67
„ 30	52	48	33	67

Table XXI.—Relative Numbers of Males and Females in Different Year-groups, Skeena River Sockeyes, in a Series of Years.

Years.	One Year in Lake.				Two Years in Lake.			
	Four Years old.		Five Years old.		Five Years old.		Six Years old.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
1912	54	46	42	58	..	..	..	..
1913	69	31	47	53	..	..	..	..
1914	60	40	47	53	..	..	..	..
1915	55	45	45	55	..	..	..	..
1916	70	30	43	57	56	44	54	46
1917	65	35	48	52	65	35	58	42
1918	63	37	46	54	61	39	56	44

Table XXII.—Skeena River Sockeyes, Run of 1918, One Year in Lake, grouped by Length, Age, and Sex.

Length in Inches.	Number of Individuals.			
	Four Years old.		Five Years old.	
	Males.	Females.	Males.	Females.
21	..	1	..	..
21½	1	3	..	..
22	9	7	..	..
22½	8	21	..	..
23	27	39	1	4
23½	35	23	1	3
24	43	21	6	19
24½	39	9	2	22
25	41	6	13	41
25½	9	2	20	20
26	12	1	34	16
26½	1	..	17	6
27	..	..	14	2
27½	1	..	5	..
28	..	..	1	..
Totals	226	133	114	133
Average length in inches	24.1	23.3	25.8	24.9

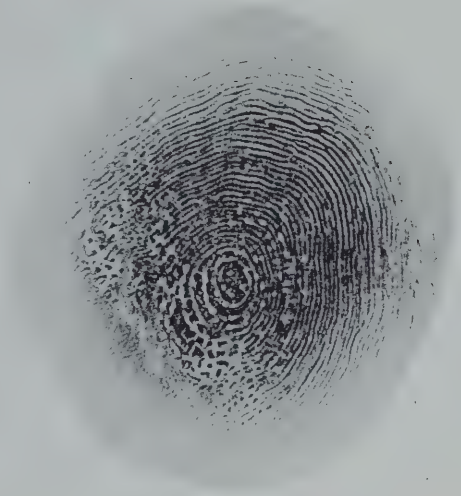

Fig. 1. Fraser River sockeye, taken at Harrison Rapids, November 15th, 1918. Male, 26½ inches long.

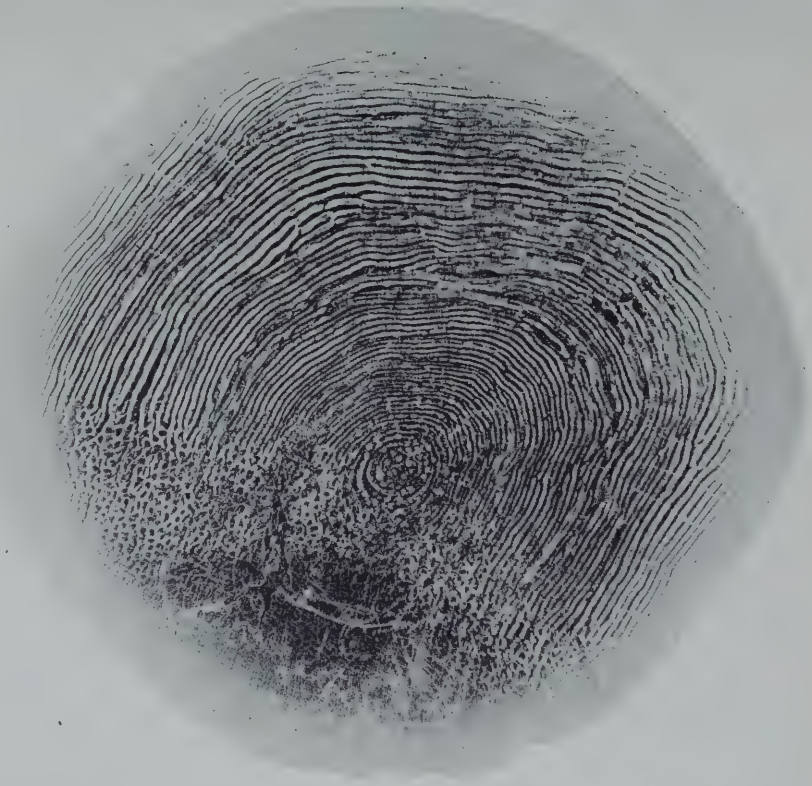

Fig. 2. Fraser River sockeye, taken at Harrison Rapids, November 15th, 1918. Female, 24 inches long.

Fig. 3. Fraser River sockeye, taken at Harrison Rapids, November 15th, 1918. Female, 23 inches long.

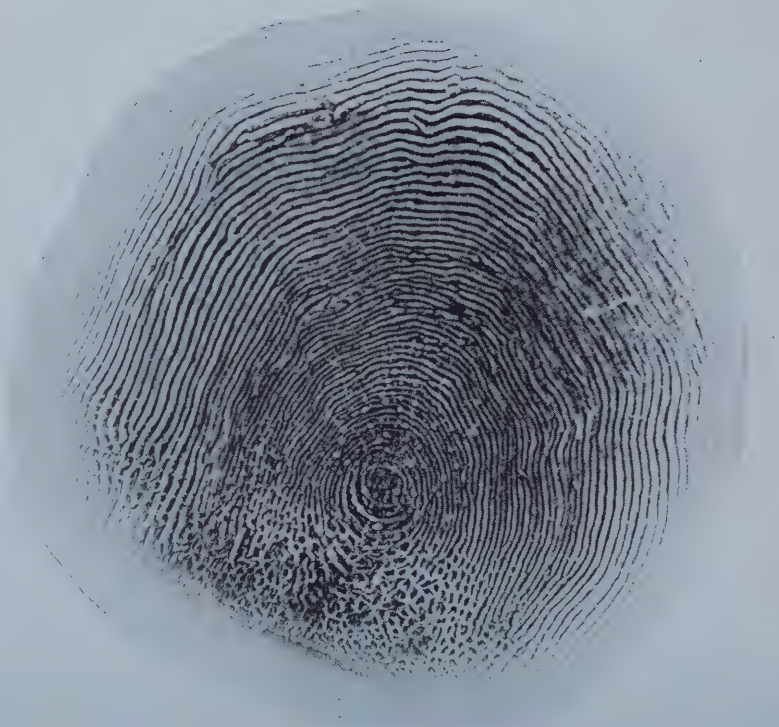

Fig. 4. Fraser River sockeye, taken at Harrison Rapids, November 15th, 1918. Female, 23½ inches long.

Fig. 5. Fraser River sockeye, taken at Harrison Rapids, November 15th, 1918. Male, 27 inches long.

Fig. 6. Fraser River sockeye from Morris Creek, taken October 11th, 1918. Male, 29 inches long.

Fig. 7. Fraser River sockeye from Morris Creek, taken October 12th, 1918. Female, 25 inches long.

Fig. 8. Fraser River sockeye from Morris Creek, taken October 22nd, 1918. Male, 28 inches long.

Fig. 9. Fraser River sockeye from the Birkenhead River, taken September 22nd, 1918. Female, 21 inches long.

Fig. 10. Fraser River sockeye from the Birkenhead River taken September 7th, 1918. Female, 24 inches long.

Fig. 11. Fraser River sockeye from the Birkenhead River, taken September 10th, 1918. Female, 25 inches long.

Fig. 12. Fraser River sockeye from the Birkenhead River, taken September 7th, 1918. Female, 24 inches long.

Fig. 13. Fraser River landlocked sockeye from the Lillooet River, taken at Skookumchuck, August 20th, 1918. Male, 12½ inches long, in its fourth year.

Fig. 13½. Fraser River landlocked sockeye, or little red-fish, taken at the Harrison Lake Hatchery, October 17th, 1918. Male, 9 inches long, in its third year.

Fig. 14. Fraser River sockeye from Hanceville, Chilcotin River, taken August 21st, 1918. Male, 27 inches long.

Fig. 15. Fraser River sockeye from Fish Canyon, Chilcotin River, taken August 24th, 1918.

Fig. 16. Fraser River sockeye from Fish Canyon, Chilcotin River, taken August 24th, 1918. Female, 23½ inches long.

Fig. 17. Fraser River sockeye from Fish Canyon, Chilcotin River, taken August 25th, 1918. Male, 23½ inches long.

Fig. 18. Fraser River sockeye from Fish Canyon, Chilcotin River, taken August 24th, 1918.

Fig. 19. Fraser River sockeye from Fish Canyon, Chilcotin River, taken August 24th, 1918.

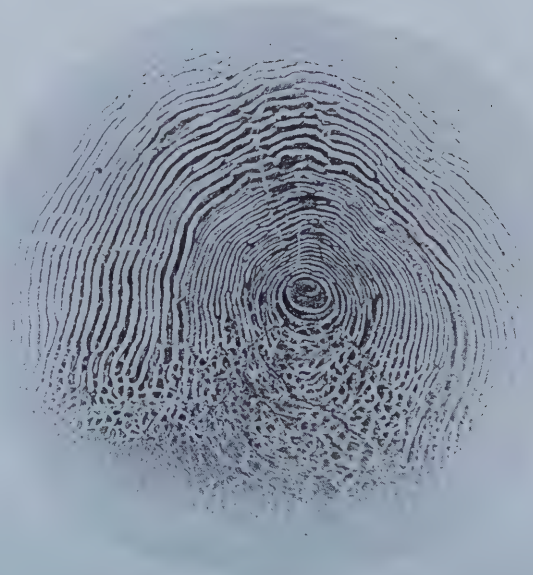

Fig. 20. Fraser River Sockeye from Hanceville, Chilcotin River, taken August 23rd, 1918. Female, 23½ inches long.

Fig. 21. Fraser River sockeye from the main river at Soda Creek, above the mouth of the Chilcotin; taken August 25th.

Fig. 22. Fraser River sockeye from Pitt Lake, taken October 27th, 1918. Male, 28 inches long.

Fig. 23. Fraser River sockeye from Pitt Lake, taken October 27th, 1918.
Male, 27½ inches long.

Fig. 24. Fraser River sockeye from Pitt Lake, taken October 27th, 1918. Female, 26½ inches long.

Fig. 25. Fraser River sockeye from the Canyon above Yale, taken August 9th, 1918. Female, 25 inches long, in fifth year.

Fig. 26. Fraser River sockeye from the Canyon above Yale, taken August 14th, 1918. Female, 25 inches long, in fourth year.

Fig. 27. Fraser River sockeye from the Canyon above Yale, taken August 8th, 1918. Male, 27 inches long.

Fig. 28. Fraser River sockeye from the Fraser River at Lytton, taken August 29th, 1918. Male, 27 inches long.

Fig. 29. Fraser River sockeye from the Thompson River at Thompson Siding, taken August 29th, 1918. Female, 24 inches long, in fifth year.

Fig. 30. Fraser River sockeye from Vancouver Island traps, taken July 10th, 1918. Female, 21 inches long, two years in lake, in fifth year. Fingerling reached the sea 5 1-10 inches long.

Fig. 31. Fraser River sockeye from Vancouver Island traps, taken July 25th, 1918. Female, 25½ inches long, in fourth year. Reached the sea as fingerling 3⅛ inches long.

Fig. 32. Fraser River sockeye from Vancouver Island traps, taken July 25th, 1918. Male, 26 inches long, two years in lake, in fifth year. Fingerling reached the sea about 5⅓ inches long.

Fig. 33. Fraser River sockeye from Vancouver Island traps, taken July 29th, 1918. Male, 23½ inches long, in fifth year. Observe small nuclear region, indicating descent to sea as yearling less than 1½ inches long.

Fig. 34. Fraser River sockeye from Vancouver Island traps, taken July 29th, 1918. Male, 27 inches long, two years in lake, in fifth year. Note extremely large nuclear region, indicating descent to sea as two-year-old when 8¾ inches long.

Table XXIII.—Skeena River Sockeyes, Run of 1918, One Year in Lake, grouped by Weight, Age, and Sex.

Weight in Pounds.	Number of Individuals.			
	Four Years old.		Five Years old.	
	Males.	Females.	Males.	Females.
3½	..	1	..	..
4	2	1	..	..
4½	16	12	2	..
5	44	48	1	5
5½	51	39	3	20
6	53	21	12	37
6½	33	9	24	34
7	20	1	31	20
7½	6	1	16	10
8	..	..	13	5
8½	1	..	5	2
9	..	..	5	..
9½	..	..	..	..
10	..	..	1	..
Totals	226	133	113	133
Average weight in pounds	5.7	5.3	6.8	6.3

Table XXIV.—Average Lengths of Skeena River Sockeyes, One Year in Lake, for Seven Successive Years.

	1912.	1913.	1914.	1915.	1916.	1917.	1918.
Four-year males	24.6	23.5	24.2	24.2	23.9	23.6	24.1
Four-year females	23.5	22.9	23.4	23.5	23.6	23.2	23.3
Five-year males	26.4	25.5	26.2	25.9	26.2	25.5	25.9
Five-year females	25.2	24.7	25.1	25.0	25.0	24.7	25.0

Table XXV.—Average Lengths of Skeena River Sockeyes, Two Years in Lake, for Three Successive Years.

	1916.	1917.	1918.
Five-year males	24.1	23.9	23.9
Five-year females	23.8	23.8	23.4
Six-year males	26.2	25.4	25.2
Six-year females	24.8	25.0	24.7

Table XXVI.—Average Weights, Skeena River Sockeyes, for Five Successive Years.

	1914.	1915.	1916.	1917.	1918.
One year in lake—					
Four-year males	5.9	5.7	5.4	5.3	5.8
Four-year females	5.3	5.2	5.1	5.0	5.3
Five-year males	7.2	6.8	7.1	6.4	6.9
Five-year females	6.3	6.2	6.3	6.0	6.4
Two years in lake—					
Five-year males	..	5.9	5.8	5.5	5.7
Five-year females	..	5.2	5.4	5.2	5.3
Six-year males	..	6.6	7.08	6.3	6.6
Six-year females	..	6.0	5.9	5.8	6.1

V. THE SOCKEYE RUN IN THE NASS RIVER, 1918.

The 1918 run of sockeyes in the Nass River agreed with 1917 as being far below the average take for the last ten years, which is a little over 30,000 cases. The pack in 1917 was only 22,188 cases and was the worst up to that date for the past decade. But the 1918 pack was only 21,316 cases.

The size of the fish in the different classes was not less than the average in good years. In the four-year fish of the one-year-in-lake type, both males and females were distinctly larger than in the two previous years, as is shown by both average lengths and average weights in Table XXVII., the averages used being for the July fish only. The sizes would have been even larger had the August run been included.

The July and the August portions of the run were as sharply marked as had previously been noted. The one-year-in-lake type, both four- and five-year classes, had practically disappeared from the August run, which was composed of individuals that had spent two years in fresh water in the fingerling stage, and others that had spent three years in fresh water. Representatives of both of these groups had been present also in July, but the July individuals, in all the groups that spent two years in the lake, averaged distinctly smaller than the August fish of the same classes. It would be interesting to follow the August fish to their spawning-grounds, which are probably distinct from those of the early run.

Table XXVII.—Nass River Sockeyes, Average Lengths and Weights of Different Classes, Runs of 1916, 1917, and 1918.

	Average Sizes of Individuals that spent							
	One Year in Lake.				Two Years in Lake.			
	Four Years old.		Five Years old.		Five Years old.		Six Years old.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
1916 (inches)	24.5	23.3	26.4	25.0	26.5	25.7	27.9	25.8
1917 (inches)	23.4	23.2	25.5	24.7	25.3	24.7	26.5	25.5
1918 (inches)	24.9	24.1	25.6	24.7	25.7	24.8	27.1	25.0
1916 (pounds)	6.0	5.3	7.2	6.3	7.2	6.2	8.1	6.4
1917 (pounds)	5.3	5.3	6.8	6.2	6.3	5.8	7.3	6.4
1918 (pounds)	6.2	5.7	7.1	6.2	7.1	6.2	8.2	6.6

Table XXVIII.—Nass River Sockeyes which ran in July, 1918, grouped by Age, Sex, Length, and by their Early History.

Length in Inches.	Number of Individuals that spent									
	One Year in Lake.				Two Years in Lake.				Three Years in Lake.	
	Four Years old.		Five Years old.		Five Years old.		Six Years old.		Six Years old.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
22	..	3	..	..	..	1	..	1	..	..
22½	..	2	..	..	2	4	..	1	..	..
23	5	7	1	3	1	6	..	..	..	..
23½	6	13	..	3	2	6	..	..	..	..
24	5	9	2	5	6	3	..	..	..	..
24½	11	16	2	11	6	9	..	5	..	2
25	17	12	6	14	9	19	1	1	..	3
25½	19	3	7	10	11	14	4	1	..	2
26	6	4	4	3	19	10	5	1	..	3
26½	6	1	6	..	22	5	3	1	1	1
27	..	..	4	..	9	2	2	..	..	..
27½	..	..	..	..	4	..	1	2	2	..
28	..	..	1	..	..	..	3	..	1	..
28½	..	..	..	..	..	..	4	..	..	..
29	..	..	..	..	..	..	2	..	..	..
29½	..	..	..	..	..	..	1	..	..	..
30	..	..	..	..	..	..	1	..	..	..
Total No...	75	70	33	49	91	79	27	13	4	11
Ave. length	24.9	24.1	25.6	24.7	25.7	24.8	27.1	25.0	27.3	25.4
Ave. weight	6.2	5.7	7.1	6.2	7.1	6.2	8.2	6.6	8.1	6.8

Table XXIX.—Nass River Sockeyes which ran in August, 1918, grouped by Age, Sex, Length, and by their Early History.

Length in Inches.	Number of Individuals that spent									
	One Year in Lake.				Two Years in Lake.				Three Years in Lake.	
	Four Years old.		Five Years old.		Five Years old.		Six Years old.		Six Years old.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
22	..	..	..	..	..	..	..	..	..	..
22½	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..
23½	..	..	..	..	..	1	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..
24½	..	1	..	..	1	5	..	..	..	..
25	1	..	..	..	..	13	..	..	..	2
25½	1	1	..	..	2	6	..	..	..	..
26	1	..	..	..	5	6	..	..	4	1
26½	..	..	..	..	6	..	1	1	4	4
27	..	..	..	..	5	..	1	..	2	1
27½	..	..	..	..	2	1	1	..	..	..
28	..	..	..	..	1	..	1	..	1	..
28½	..	..	..	..	..	..	2	..	..	..
Total No...	3	2	..	..	22	32	6	1	11	8
Ave. length	25.5	25	..	..	26.4	25.2	27.6	26.5	26.5	26.1
Ave. weight	7	6	..	..	7.2	6.5	8.5	7.5	7.8	6.8

Table XXX.—Percentages in each Class of Nass River Sockeyes running at Different Dates in 1918.

1918.	One Year in Lake.		Two Years in Lake.		Three Years in Lake.	
	Four Years.	Five Years.	Five Years.	Six Years.	Six Years.	Seven Years.
June 26	35	25	40	..	..	..
July 2	27	14	59	..	..	..
„ 5	57	13	23	7	..	..
„ 8	43	37	12	6	2	..
„ 11	40	32	22	6	..	..
„ 16	27	22	37	14	..	..
„ 19	22	13	45	16	4	..
„ 23	22	19	49	8	2	..
„ 25	10	2	63	6	19	..
„ 30	5	9	61	18	7	..
Aug. 2	10	..	60	7	23	..
„ 5	2	..	68	9	21	..

STATEMENT SUBMITTED TO THE AMERICAN-CANADIAN FISHERIES COMMISSION BY THE HON. WILLIAM SLOAN, COMMISSIONER OF FISHERIES, AT THE VANCOUVER MEETING, 1918.

Gentlemen of the Commission,—As the Commissioner of Fisheries for the Province of British Columbia, I desire to comment briefly on the present precarious condition of the sockeye-salmon fishery of the Fraser River. The watershed of that river and its channels lie wholly within the Province. From its watershed have come all but a fraction of the sockeye that have been taken in the waters contiguous to the International Boundary-line which separates the Province of British Columbia and the State of Washington. From that watershed must continue to come the seaward migrants of sockeye which produce the commercial runs of sockeye to those waters, because there is no other watershed tributary to those waters which affords sufficient spawning and rearing waters for sockeye salmon. The vast runs of former big years demonstrates the extent and the value of the runs that that watershed can produce. It is the greatest sockeye-producing watershed known. No other watershed has produced such vast numbers of sockeye. That watershed is to-day as capable as ever of producing the vast run of the past. It has not been contaminated. Settlement, power and irrigation have not injured it in any way. It needs only to be protected to produce the great runs of the past. Its produce has been lessened—almost destroyed—because a sufficient number of spawning sockeye has not been permitted to reach it. The runs in the three last years have steadily decreased because too few of the adult salmon have escaped capture in Dominion and State waters; because of excessive fishing too many have been captured. The run of the big year was further destroyed by a rock-slide blocking the river-channel at Hell's Gate in 1913.

That the runs in the three last years have been almost wiped out by commercial fishing and that the run in the big year has been alarmingly decreased has been ably demonstrated by statements already submitted to you. It is unnecessary here to more than call your attention to the evidence of depletion already in your hands. I do, however, accentuate the fact that the evidence submitted to you by our Department is founded upon scientifically ascertained facts. The watershed of the Fraser and the fishing areas supplied by it have been under close scrutiny since 1901. No other has been so carefully observed. The history of the race of sockeye that frequent the Fraser is better known than that of any other district. The facts are no longer questioned. The run of sockeye to the Fraser is periously near to extermination. They will be exterminated if conditions remain as they are, and in so short a period as to wipe out all interests of both fishermen and canners. In view of the evidence there is, in my judgment, but one thing to do. Adopt measures that will ensure to the watershed all the sockeye that still survive. To that end I would suggest that the total prohibition of sockeye-fishing in the waters frequented by those produced in the Fraser River until such time as they have recovered from their depleted condition. I suggest this though it does involve compensation to resident fishermen and canners who can establish that they are entitled to compensation by their respective Governments. It is fruitless to rely upon concurrent regulations in British Columbia and the State of Washington waters. That has been tried and failed. Such efforts will continue to fail. Present commercial and monetary considerations must be eliminated. It must be in an international way, because it is an international question. It is one of the greatest fishery questions in which Canada and the United States are now concerned. The only adequate, the only permanent solution of this question, I submit, is the acquisition by Canada and the United States of all the rights in this fishery of which they may not now be in possession. That being established, the waters should be closed to sockeye-fishing for such a period of time as is necessary to restore the runs to the abundance of former big years. When that has been accomplished, let fishing be resumed under supervision and for the benefit of the two nations until such time as they have been recouped for their expenditures, and thereafter in such manner and to the end that the supply may not again become depleted.

I submit, gentlemen, that the Governments of Canada and the United States should recognize that the conditions confronting them demand such treatment. There is no gainsaying the evidence. The watershed of the Fraser River will, when adequately protected, produce more

sockeye salmon than any known watershed. It produced in 1913 2,300,000 cases. In the three following lean years it produced an average of but 267,000 cases per year. Being in possession of a watershed capable of producing 2,300,000 cases a year, can any Government be content with conditions by which but 267,000 cases are produced, and the continuance of which will entirely destroy any production whatever? The evidence in the case is conclusive—it is undisputed; the fishery is in a precarious condition. There is, however, a difference of opinion as to the remedies to be applied. I submit that those best qualified to speak have made it plain that no temporary measures will produce desired results. The races of sockeye that frequent the Fraser cannot be restored by any half-way measure. To allow the destruction of the sockeye-fisheries of the Fraser River would be an unnatural, immoral, and unpatriotic policy.

The questions here involved are similar to those in the fur-seal case. They are international in character, and not Provincial or State questions, and must be dealt with upon broad national lines and in the interests of the people of Canada and the United States.

Faithfully yours,

WM. SLOAN,

Commissioner of Fisheries for British Columbia.

STATEMENT MADE BY JOHN P. BABCOCK, ASSISTANT TO THE COMMISSIONER OF FISHERIES FOR BRITISH COLUMBIA, AT VANCOUVER MEETING OF THE AMERICAN-CANADIAN FISHERY CONFERENCE, 1918.

MR. CHAIRMAN AND GENTLEMEN OF THE INTERNATIONAL FISHERIES COMMISSION,—The outstanding features of the salmon-fishery of the Fraser River District, in my judgment, are the depletion of the runs and the potentialities of the watershed. Because depletion has been shown, and is universally admitted, I shall confine attention to the latter.

The Watershed,—The watershed of the Fraser River contains a greater area of tributary fresh-water lakes than are found in any other on the Coast. The Fraser drains the major portion of the south-eastern section of the Province of British Columbia. Three of the largest lakes on the Pacific slope and five others of large area contribute their waters to the Fraser and afford spawning areas and rearing waters for a countless number of sockeye salmon. No other known watershed affords such an extended spawning area. No other watershed produced in a single year such vast numbers of sockeye. The great runs of 1901, 1905, 1909, and 1913 demonstrate the harvest that watershed will afford when abundantly seeded. The great catches of those years—ranging from 1,572,000 to 2,401,000 cases—demonstrates the number of fish that may safely be taken without injury to the runs of the future, because, notwithstanding such great catches, every section of the spawning area of the watershed was shown to have been abundantly seeded in 1901, 1905, and 1909, and there is evidence to show that its spawning area would have been as abundantly seeded in 1913 but for an accident.

Since 1901 I have made a study of conditions on the fishing and spawning grounds of the Fraser River. I first inspected its spawning area in 1901. As the agent of the Provincial Government I have inspected that watershed during the spawning period every year since, with the exception of the years 1910 and 1911. The annual publication of the Provincial Government contains my yearly reports.

As the result of my inspections, I feel fully justified in submitting that the major portion of the great runs of 1905, 1909, and 1913 were the product of the sockeye that spawned in that section of the watershed of the Fraser that lies north of the great canyon in the Coast ranges, commonly termed "the Fraser River Canyon." And that the major portion of the runs in the alternate years—the lean years—were the product of the sockeye that spawned in that section of the watershed that lies to the south and west of the Fraser River Canyon. In the discussion of this question the former is here termed the upper section of the Fraser River watershed, and the latter the lower section of the Fraser watershed. In my judgment, the great runs of

the big years have very largely consisted of fish propagated in the upper section, plus the normal yearly product of the lower section. The runs in the alternate, or lean, years have been the normal yearly product of the lower section plus the small numbers produced in the lean years from the beds of the upper section.

In the big years 1901, 1905, and 1909 every spawning-bed in the upper section was crowded with sockeye. They were found there in incredible numbers. The beds of that section in 1913 showed an alarming decrease. While over 4,000,000 sockeye were recorded as entering Quesnel Lake in 1909, but 550,000 were shown to have entered that lake in 1913, and less than 28,000 in 1917. Furthermore, similar conditions were shown to have existed in all the lake districts of the upper section in 1913 and 1917. The number of sockeye that reached the beds of the upper section in 1917 were shown to have been very much less than in 1913, and little, if any, more numerous than in some recent lean years. The records of the upper section in 1913, and again in 1917, demonstrate that the conditions which produced the big runs in 1905, 1909, and 1913 no longer exist, that the big year run has been destroyed, and that hereafter the runs of those years must be classed with the runs in the lean years. In the alternate—the lean—years the spawning-beds of the upper section were but sparingly seeded up to 1906 and have not been as well seeded since. Gradually, with one or two exceptional years, the number of sockeye which reached the upper section in the lean years has notably declined. Every district in the upper section shows a decline. Hatcheries located at Shuswap and Seton Lakes, the only hatcheries in the upper section, have been closed because a sufficient number of sockeye have not reached those lakes in recent years to afford a supply of eggs. No eggs were or could have been collected at either of those lakes in the last three years.

Passing to the spawning area of the lower section of the Fraser, the record discloses that from 1901 to 1917 there was no pronounced increase in the run in the big years over the run of the lean years. That there has been as many fish on those beds in the lean years as in the big years. This is especially true of the runs to Lillooet and Harrison Lakes, the two great lakes of the lower section. The runs to this section have shown a steady decline. There were less sockeye in this section in 1917 than in any former year, big or lean, on record, and less eggs were secured for the hatcheries.

Because the bulk of the run of the big years issues from the upper section of the watershed, and because there has been no noticeable increase in the number of sockeye on the beds of the lower section in those years, it appears that the condition which originally brought about the phenomenon of the big run and the three following small runs of sockeye to the Fraser was of such a character as to have affected only the run to the upper section and yet did not affect the run to the lower section.

Because the run to every lake district of the upper section was equally affected we are warranted in assuming that the point of obstruction was located below the junction of the Thompson and the Fraser Rivers. Because the run was affected for three years only, it is assumed that the barrier, or blockade, was of such a character as to have affected the run in those years only and did not affect the run in the fourth year; that in the fourth year it had worn away or been removed by high water to an extent that permitted the run of that year to reach the spawning-beds of the upper section.

The channel of the Fraser through the canyon extending from Yale to Cisco is exceedingly narrow at many points. Towering cliffs of rock line its banks. A rock-slide such as the one that occurred in that canyon, at Hell's Gate, in 1913 could easily have produced a similar result at an earlier period of time, and just as effectively cut off the run for a number of years as the slide of 1913 would have done had it not been removed by the Dominion Government in 1914. Great as was the slide of 1913, it did not cut off all of the early run of sockeye of that year. Owing to extreme high water in July numbers of sockeye were enabled to pass through, as was demonstrated by the fish reaching Quesnel and Chilko Lakes.

Assuming, then, that we have here a reasonable theory of the origin and the nature of the barrier that cut off the sockeye from the spawning area of the upper section of the Fraser which resulted in the phenomenon of the one big year and three lean year runs of sockeye, let us speculate as to the extent of its effect upon the runs of the three lean years. The barrier may have been sufficient to have cut off a portion of the run only, or it may have cut off the entire run. If a portion of the run at extreme high or low water was enabled to pass, that portion would have furnished the nucleus—the seed—for a run four years later.

If we assume that the entire run was cut off from the upper section for one or all of the three years of the cycle, we must furnish a plausible, a workable, theory to account for the restoration of the runs in the three lean years. That is not difficult. Dr. Gilbert, by his study of the growth and structure of the scales of the sockeye, has demonstrated that, while the race of sockeye that frequent the Fraser are predominately four-year old fish, there is in the run of every year three-year-old, four-year-old, and five-year-old fish. He demonstrated "clearly that in the Fraser basin a high percentage of four-year fish accompanied a large pack, or, stated conversely, a small pack is occasioned mainly by a deficiency in four-year-old fish."*

In four runs he found an average of 82 per cent. of four-year-old fish. In the catch of 1912 he found 21.5 per cent. of three-year-old fish and 10 per cent. of five-year-old fish. The presence of from 54 to 99 per cent. of four-year-old fish in five consecutive runs, and plus per cent. to 46 per cent. of five-year-old fish in the same runs, establishes the fact that from each year's spawning a proportion of five-year-old fish are produced. We have here evidence of the existence in the run of the year that was not obstructed the nucleus for a future run. The period taken to build up a run from such a scant seeding must have been an extended one. Had this constituted the only seed that reached the beds in the three lean years, the run following the big year should have been more readily built up than the run in the two following years. In fact, the record of the pack demonstrates that the catch in the year following the big run has always been greater than in the two following years.

We are not, however, confined to the conclusion that if the run for three years was entirely destroyed the run in the lean years was built up entirely from the spawning of five-year-old fish. Granting the premises of the home-stream theorists that salmon bred in a stream return to that stream to spawn because the weight of evidence favours their contention, there is abundant evidence on this Coast and in New Zealand, where the Pacific salmon have been established, to show that some of the salmon bred in one stream have on reaching maturity entered a different stream to spawn. Further, it has not been shown or claimed that all the fish bred in a watershed return to the identical tributary of that watershed in which they were propagated. There is sufficient evidence to warrant the conclusion that some salmon propagated in the lower section of the Fraser have entered the upper section and spawned there. We have therefore three strings to our bow to account for the existence of the runs of the lean years: (1) The escapes at high or low stages of water during the original blockade; (2) the overlapping five-year-old fish bred in the upper section by the run that did survive; and (3) the fish bred in the lower section that passed to the upper section and spawned there.

The building-up of a run to the upper section of the Fraser by any or all of the measures here indicated would of necessity have taken a long period of time. We cannot estimate it, but we are not compelled to place it in the dark ages, or even two or three centuries ago. We can, however, postulate that during that period the Indians of the upper section and in the Fraser Canyon were catching such fish as they could secure up to the limit of their demands, and were in consequence interfering with a more rapid development of a run. The records of Simon Fraser, the discoverer and original navigator of the river that bears his name, written more than a century ago—1806-11—establishes the fact that there was in those years a big run every fourth year and a light run in each of the three succeeding years in the Upper Fraser. He also furnishes evidence to show that in some of the lean years the Indians at Stuart and Fraser Lakes could not supply his post with all the salmon he required, and that an additional supply was obtained from the post at Kamloops, where the run appears to have been larger or the demand less; indicating at that time the Indians could not obtain from Stuart and Fraser Lakes all the fish they desired.

This matter has been treated at length that it may be appreciated that the period of time necessary to restore a depleted run to a run of commercial importance is under natural conditions a long one, and because it has been stated that the failure of nature to have equalized the runs of sockeye in the Fraser demonstrated that the runs in the lean years could not be developed to the proportions of a big-year run. I sumbit that there is no force in that contention. The runs in the lean years will equal the runs of former big years four years following as abundant seeding as the beds received in either 1901, 1905, and 1909. It is only a matter of seeding the spawning area abundantly.

* B.C. Fishermen Report, 1915, pages 29 and 30.

Mr. Secretary Redfield requested that in advocating restrictive measures I should consider the present demand for foods, and that he would like me to express my views on the subject. In reply, let me submit: The average pack of Fraser River sockeye in Washington and British Columbia in the last three lean years totalled but 267,000 cases. The reports from the spawning-grounds of the Fraser in these years give no promise that the runs in the following three lean years will equal that average. If that be true, the best we can expect is *267,000* cases per year. Is the food shortage so serious as to demand that the few remaining sockeye of the Fraser run be drawn upon to supply that number of cases?

Permit me, gentlemen, to draw my remarks to a conclusion by quoting from the very able statement furnished you by my mentor, Dr. Gilbert:—

"The Fraser River presents unexampled opportunities for productiveness and wealth. The people need the enormous supplies of highly valuable food which the river is able to produce annually. It should not be permitted to remain at its present low rate of production. . . . The people need the food. They will come to need it in future years even more sorely than they do at the present. No private interests should be permitted to stand in the way of restoring this producer of food to the public.

"If the Fraser River were a private monopoly, to be henceforth wisely handled, there can be no doubt it would now be promptly closed to commercial fishing for a term of years, and the entire run—now so sadly dwindled—dedicated to purposes of propagation. This should be done without further delay for at least one cycle of four years, and the results carefully noted by a continued study of the spawning-beds. . . . If the river were closed to fishing for one cycle of four years, we could know fairly well in advance what the result was to be, and could then either open the river and sound to restricted fishing if conditions should warrant, or, if necessary, close it for a future period of four years. This is the only method to restore the sockeye run with any promptness and with any certainty of success.

"So great has been the reduction of the runs, we cannot predict with any optimism what would be the result of less drastic measures. If the amount of fishing-gear in use be limited and the weekly closed season be extended, undoubtedly a somewhat larger proportion of fish would reach the beds. But it must be borne in mind that it is not the proportion of a given run which spells success, but the actual numbers of spawners. The whole of a sadly depleted run may be all too few to produce the desired results. It is greatly to be feared that any restriction in the present case which would be so moderate as still to leave it profitable for canners to operate in the face of such reduced runs can accomplish little or nothing towards restocking of the river. The only wise course—the only adequate remedy—is to close the river for a term of years by concurrent action of the two Governments."

Yours respectfully,

JOHN PEASE BABCOCK.

Assistant Commissioner of Fisheries.

MIGRATION OF ADULT SOCKEYE SALMON IN PUGET SOUND AND FRASER RIVER.*

By Henry O'Malley, Field Assistant, U.S. Bureau of Fisheries, in Charge of Operations on the Pacific Coast, and Willis H. Rich, Field Assistant, U.S. Bureau of Fisheries.

INTRODUCTION.

During the American-Canadian Fisheries Conference on the Pacific Coast in April and May, 1918, the question was constantly raised as to the time required for the sockeye salmon of Fraser River to pass through Puget Sound.

In order to determine this important question, Dr. Hugh M. Smith, United States Commissioner of Fisheries, and W. A. Found, Superintendent of the Canadian Fisheries, decided to carry out an extensive marking experiment. Early in July the authors were detailed to take immediate charge for the United States Bureau of Fisheries, and to confer with Lieut.-Colonel F. H. Cunningham, acting for the Canadian Government. The final arrangements were that the Canadian fisheries authorities would handle the marking operations in Canadian waters and the United States Bureau of Fisheries the marking operations in Puget Sound, and that each Government would attend to the collecting of data in its respective waters.

The authors are especially indebted to H. J. Todd & Sons; E. B. Deming, Pacific American Fisheries; W. A. Lowman, Coast Fish Co.; Frank Wright, Carlisle Packing Co.; and J. W. Elliott, Alaska Packers' Association. Without the co-operation of these men and the members of their respective organizations it would have been impossible to have successfully conducted this experiment. L. H. Darwin, Washington State Fish Commissioner, and his deputies also rendered valuable assistance. Many helpful suggestions were received from Dr. Charles H. Gilbert, of Stanford University.

PROCEDURE.

Tags and their Attachment.

The method adopted for procuring the desired data was to mark with serially numbered tags enough adult sockeye salmon so that a sufficient number of returns could reasonably be expected. After consideration of several types of tags the one finally accepted was of the "bachelor-button" type, similar to those in use for marking cattle and other live stock. This button comes in two separate halves, each with a hollow central extension which forms the shaft of the complete button. The shaft of one half of the button is small enough to pass through the shaft and long enough to extend slightly beyond the face of the other half. When placed together in the proper position the two halves are fastened by means of a special crimping-tool. This is built on the general plan of a pair of pliers; but the jaws meet only toward the tips, at which points are conical elevations. By fitting these elevations into the open ends of the shaft and closing the tool firmly, the end of the smaller inner shaft is spread sufficiently to prevent its being pulled back through the outer shaft.

The buttons were made of either silver or aluminium. Some fear was entertained that the aluminium might corrode in the salt water sufficiently to make it difficult or impossible to read the numbers, but in this experiment there was absolutely no difficulty on this account. No corrosion is noticeable on any of the buttons returned, although some of them must have been three or four weeks in practically pure salt water. This is contrary to the experience of Greene,† who found that salt water had a strongly corrosive action on aluminium buttons of similar style. This may be due to some slight difference in the alloy of which the buttons were made.

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* Reproduced from advance sheets furnished the Department by Dr. Hugh M. Smith, United States Commissioner of Fisheries.

† Greene, Charles W.: The Migration of Salmon in the Columbia River. Bulletin, U.S. Bureau of Fisheries for 1909, Vol. XXIX., pages 129-148. Washington, 1911.

The buttons were attached to the upper lobe of the caudal (tail) fin. It was first necessary to cut a hole of the proper size to admit the shaft of the button. This was done by means of an ordinary leather-punch. Figs. 1 to 4 show, *in situ*, both sides of two buttons which were returned.*

The operation of attaching the tags required, usually, less than one minute and no particularly unfavourable results of tagging were noticed. At some of the stations where the marking was done the fish were held in crates until after the marking for the day was complete, and it was noticed that they soon recovered from the effects of being out of water while the tag was being attached and were apparently in perfect condition when liberated.

Reports that the tags were "worrying" the fish and causing them to wear their tails in an effort to remove the tags were investigated and found to be quite unfounded. Tails of several fish have been preserved and show no indication of such wearing as had been asserted. Figs. 1 and 2 are from such a specimen.

The fish to be marked were taken from the traps at the time of lifting and were held either in crates or in one of the pockets of the spiller until they could be marked and released.

Marking-stations.

Marking-stations were established at five points in Puget Sound, as follows: Near Sooke, Vancouver Island, British Columbia; Salmon Banks, just south of San Juan Archipelago; near Point Partridge, Whidbey Island; near Village Point, Lummi Island; and at the last trap in American waters on Point Roberts. For convenience these have been designated in the following pages as Stations A, B, C, D, and E, respectively.

The work at these stations was in charge of the following men:—

A. Sooke, B.C.—W. H. Rich, Field Assistant, United States Bureau of Fisheries (July 14th to 23rd); Dr. C. McLean Fraser, Director of the Biological Station, Nanaimo, British Columbia (July 23rd to the end of the season); Alex. Robertson, Superintendent, Harrison Lake Hatchery, Dominion Fisheries Department.

B. Salmon Banks—Walter C. Buckmaster, Apprentice Fish-culturist, United States Bureau of Fisheries.

C. Point Partridge—Clive L. Henry, Apprentice Fish-culturist, United States Bureau of Fisheries.

D. Lummi Island—Don E. Courser, Apprentice Fish-culturist, United States Bureau of Fisheries.

E. Point Roberts—Joseph Kemmerich, Foreman, United States Bureau of Fisheries.

The last four of these stations were under the general supervision of Dennis Winn, Field Superintendent, United States Bureau of Fisheries.

Collection and Organization of Data.

In the collection of data reliance was necessarily placed in fishermen, trap-tenders, and cannerymen. A reward of 25 cents was offered for the return of each button accompanied by information giving the date and place of capture. Specimens taken in American waters were taken care of by Dennis Winn, at the Seattle office of the United States Bureau of Fisheries, and those taken in Canadian waters by Colonel Cunningham, at the office of the Dominion Fisheries Department at New Westminster, British Columbia. One of the tags reported from the upper regions of the Fraser River was secured by J. P. Babcock, Assistant to the Commissioner of Fisheries for the Province of British Columbia.

While the majority of these records are considered approximately correct, data secured in this manner are necessarily subject to some inaccuracies, both as to time and place of capture. In the authors' opinion, however, these inaccuracies will be balanced, so that with reasonably large series the averages should be reliable. In cases where the data were obviously wrong the records have been omitted. This has been done in several instances where the date given for the capture was earlier than that on which the fish was recorded as having been marked. A number of tags were returned with incomplete data, either the date or the place of capture, or both, wanting. All such cases have been omitted entirely from consideration.

For the convenient organization of the data the American waters of the sound from which returns were reported have been divided into nine regions. Several factors guided in establishing

* Not shown in this reprint.

Burrard Inlet
FRASER RIVER
Boundary Bay
International Boundary
Blaine
GEORGIA STRAIT
SATURNA
ORCAS ISLAND
SAN JUAN ISLAND
LOPEZ ISLAND
ROSARIO STRAIT
Bellingham Bay
Victoria
Sooke Inlet
Deception Pass
JUAN DE FUCA STRAIT
10
9
8
7
6
5
4
3
2
1
A
B
C
D
E

the boundaries of these regions: (1) The general geography of the district; (2) the grouping of traps; and (3) the nature of the descriptions giving the locality where the tags were recovered. These last frequently indicated merely the general region in which the tag was taken; i.e., Rosario Strait. The boundaries of these regions, as well as the location of the marking-stations, are shown on the accompanying map. All of the records reported from the Canadian waters which are open to commercial fishing have been treated together. For this reason that part of the Strait of Georgia just outside the mouths of the Fraser River and the river itself, from the mouth to Mission Bridge, together constitute the tenth region. The reasons for so treating the Canadian returns will be given later.

STATISTICAL STUDY OF DATA.

General Features.

In the following study the chief concern is with what is believed to be a strict and reasonably complete presentation of the facts. There has been no attempt to draw conclusions regarding the bearing of these facts upon the particular problems connected with the conservation of the sockeyes of the Fraser River. Some of the tables present similar data as seen from different points of view. This has, perhaps, been carried to an extreme in order that all obtainable facts might be available. Other tables are presented rather as matters of record than as having any especial bearing on the main problems in hand. For the most part such tables are presented without detailed comment.

Raw Data.

Table 1 gives for each marking-station the numbers of the tags attached each day. As noted in the table, silver tags were used only at Sooke (Station A). At all other stations aluminium tags were used, and the first few tags used at Sooke were also of aluminium, Nos. 5 to 29, inclusive.

Table 1.—List of Tag Numbers attached at each Marking-station.

Station A, Sooke, British Columbia.*

Numbers.		Date.	Total.	Numbers.		Date.	Total.
From	To			From	To		
		1918.				1918.	
5	8	July 14	4	1718	1822	July 31	105
9	29	„ 21	21	1823	1900	Aug. 1	77
1326	1350	„ 21	25	1901	2038	„ 2	138
1353	1362	„ 22	10	2039	2078	„ 4	41
1363	1382	„ 23	20	2088	2100	„ 4	23
1383	1390	„ 24	8	2080	2087	„ 6	8
1391	1447	„ 25	56	2101	2123	„ 6	23
1448	1545	„ 27	98	2125	2127	„ 6	3
1546	1617	„ 28	72				
1618	1717	„ 30	99			Total	831

Station B, Salmon Banks, Wash.

3001	3025	July 21	25	3455	3490	July 31	42
3026	3065	„ 22	40	3497	3600	Aug. 1	104
3066	3160	„ 23	95	3601	3664	„ 2	64
3161	3216	„ 24	56	3665	3758	„ 4	94
3217	3266	„ 25	50	3759	3800	„ 5	42
3267	3377	„ 26	111	3801	3836	„ 7	36
3401	3454	„ 28	54				
3378	3394	„ 30	17			Total	836
3395	3400	„ 31	6				

Station C, Point Partridge, Wash.†

1001	1043	July 17	43	1547	1664	Aug. 7	118
1044	1093	„ 19	50	1665	1769	„ 9	105
1094	1154	„ 22	61	1770	1924	„ 13	155
1155	1230	„ 24	76	1925	2000	„ 14	76
1231	1382	„ 26	152				
1383	1546	Aug. 6	164			Total	1,000

* Tag Nos. 5 to 29, attached at Station A, and the tags used at all other stations were aluminium. With the exception of those noted, all tags attached at Station A were of silver.

† This is the official list as given by the assistant having charge of the marking at this station. The records for August 6th and subsequent dates are subject to suspicion on account of an admitted lack of veracity in the accounts. Previous to this date Dennis Winn was present at the markings.

Table 1.—List of Tag Numbers attached at each Marking-station—Concluded.

STATION D, LUMMI ISLAND, WASH.

Numbers.		Date.	Total.	Numbers.		Date.	Total.
From	To			From	To		
		1918.				1918.	
2001	2085	July 19	85	2478	2555	Aug. 5	78
2086	2177	„ 23	92	2556	2649	„ 6	94
2178	2251	„ 24	74	2650	2690	„ 7	41
2252	2314	„ 28	63	2691	2737	„ 9	47
2315	2360	„ 30	46				
2361	2416	Aug. 2	56			Total	737
2417	2477	„ 4	61				

STATION E, POINT ROBERTS, WASH.

4001	4095	July 25	95	4819	4834	Aug. 7	16
4096	4165	„ 26	70	4835	4952	„ 8	118
4166	4258	„ 29	93	30	85	„ 15	56
4259	4372	„ 30	114	86	97	„ 16	12
4373	4494	„ 31	122	98	120	„ 19	23
4495	4533	Aug. 1	39	121	151	„ 20	31
4534	4630	„ 2	97	152	167	„ 21	16
4631	4743	„ 5	113				
4744	4814	„ 6	75			Total	1,090

Table 2 gives in serial order a complete list of the tags returned, showing the place where and the date on which the tags were attached and the date and region of capture. Tables 1 and 2 contain the raw data from which all of the subsequent tables were constructed.

Table 2.—List of Tags returned.

TAGS ATTACHED AT STATION A, SOOKE, BRITISH COLUMBIA.

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
7	July 14	July 19	2	5	1455	July 27	July 30	1	3
12	„ 21	„ 23	9	2	1463	„ 27	Aug. 2	6	6
14	„ 21	Aug. 1	8	11	1467	„ 27	July 31	9	4
16	„ 21	„ 26	*	36	1468	„ 27	„ 30	6	3
19	„ 21	„ 1	†	11	1473	„ 27	Aug. 3	7	7
21	„ 21	July 24	7	3	1477	„ 27	„ 5	7	9
25	„ 21	„ 25	9	4	1481	„ 27	July 29	6	2
26	„ 21	„ 23	2	2	1486	„ 27	„ 31	6	4
27	„ 21	„ 25	1	4	1505	„ 27	Aug. 1	‡	5
28	„ 21	„ 24	2	3	1512	„ 27	„ 6	6	10
29	„ 21	„ 31	6	10	1513	„ 27	July 28	§	1
1328	„ 21	„ 25	2	4	1515	„ 27	Aug. 4	7	8
1331	„ 21	„ 26	2	5	1519	„ 27	Sept. 14	‖	49
1332	„ 21	„ 23	1	2	1529	„ 27	July 30	6	3
1335	„ 21	„ 24	2	3	1538	„ 27	Aug. 5	7	9
1339	„ 21	„ 24	2	3	1543	„ 28	July 30	7	2
1342	„ 21	„ 28	9	7	1546	„ 28	„ 29	6	1
1353	„ 22	„ 28	2	6	1549	„ 28	„ 29	1	1
1357	„ 22	„ 26	10	4	1551	„ 28	Aug. 1	‡	4
1359	„ 22	„ 30	10	8	1565	„ 28	„ 4	7	7
1362	„ 22	„ 23	1	1	1573	„ 28	„ 23	9	26
1368	„ 23	Aug. 30	10	7	1588	„ 28	„ 2	6	4
1371	„ 23	July 31	10	8	1591	„ 28	„ 9	6	12
1390	„ 24	„ 29	6	5	1592	„ 28	„ 5	10	8
1404	„ 25	„ 29	9	4	1593	„ 28	„ 4	8	7
1405	„ 25	„ 28	1	3	1597	„ 28	„ 9	6	12
1407	„ 25	Aug. 4	1	10	1602	„ 28	„ 4	7	7
1423	„ 25	July 30	8	5	1607	„ 28	„ 4	8	7
1449	„ 27	Aug. 1	10	5	1610	„ 28	July 31	6	3

* Hell's Gate, 80 miles above Mission, Fraser River.
† Yale, 60 miles above Mission, Fraser River.
‡ No Point trap, Vancouver Island.
§ Beachy trap, Vancouver Island.
‖ Samaquam, Lillooet River, 25 miles above Harrison Lake, 90 miles above Mission.

Table 2.—List of Tags returned—Continued.

Tags attached at Station A, Sooke, British Columbia—*Concluded.*

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
1617	July 28	Aug. 2	10	5	1838	Aug. 1	Aug. 9	10	8
1619	„ 30	„ 1	4	2	1839	„ 1	„ 4	7	3
1629	„ 30	„ 7	8	8	1843	„ 1	„ 6	2	5
1633	„ 30	„ 7	7	8	1844	„ 1	„ 7	8	6
1637	„ 30	„ 6	2	7	1845	„ 1	„ 5	7	4
1646	„ 30	„ 1	*	2	1852	„ 1	„ 4	1	3
1653	„ 30	„ 6	7	7	1854	„ 1	„ 6	6	5
1658	„ 30	„ 1	*	2	1855	„ 1	„ 4	2	3
1662	„ 30	„ 1	*	2	1857	„ 1	„ 5	6	4
1663	„ 30	„ 7	9	7	1870	„ 1	„ 5	7	4
1664	„ 30	„ 11	6	12	1873	„ 1	„ 7	7	6
1665	„ 30	„ 1	*	2	1889	„ 1	„ 5	8	4
1667	„ 30	„ 11	8	12	1901	„ 2	„ 6	6	4
1672	„ 30	„ 9	7	10	1902	„ 2	„ 8	10	6
1673	„ 30	„ 5	6	6	1903	„ 2	„ 7	9	5
1682	„ 30	„ 1	1	1	1904	„ 2	„ 6	8	4
1686	„ 30	„ 6	2	7	1905	„ 2	„ 7	8	5
1697	„ 30	July 31	1	1	1907	„ 2	„ 5	7	3
1699	„ 30	Aug. 8	9	9	1920	„ 2	„ 13	9	11
1712	„ 30	„ 5	9	6	1929	„ 2	„ 13	2	2
1714	„ 30	„ 1	9	2	1935	„ 2	„ 8	7	6
1721	„ 31	„ 5	8	5	1957	„ 2	„ 4	1	2
1727	„ 31	„ 3	7	3	1958	„ 2	„ 6	7	4
1735	„ 31	„ 18	10	18	1964	„ 2	„ 5	*	2
1738	„ 31	„ 4	2	5	1986	„ 2	„ 5	2	3
1739	„ 31	„ 8	7	8	1992	„ 2	„ 2	7	1
1753	„ 31	„ 14	8	14	1996	„ 2	„ 4	7	2
1756	„ 31	„ 5	8	5	2004	„ 2	„ 8	8	6
1761	„ 31	„ 6	7	6	2015	„ 2	„ 6	6	4
1764	„ 31	„ 4	7	4	2018	„ 2	„ 12	10	10
1767	„ 31	„ 11	7	11	2024	„ 2	„ 6	6	4
1769	„ 31	„ 9	10	9	2029	„ 2	„ 7	7	5
1778	„ 31	„ 11	7	11	2032	„ 2	„ 9	8	7
1780	„ 31	„ 16	8	16	2050	„ 4	„ 8	8	4
1783	„ 31	„ 5	6	5	2053	„ 4	„ 6	10	33
1786	„ 31	„ 18	10	18	2071	„ 4	„ 7	7	3
1796	„ 31	„ 12	7	12	2073	„ 4	„ 11	9	7
1797	„ 31	„ 7	8	7	2074	„ 4	„ 7	1	3
1801	„ 31	„ 18	8	18	2093	„ 4	„ 7	2	3
1806	„ 31	„ 13	8	13	2097	„ 4	„ 8	8	4
1814	„ 31	„ 6	6	6	2100	„ 4	„ 9	8	5
1815	„ 31	„ 5	7	5	2103	„ 6	„ 9	8	3
1816	„ 31	„ 5	8	5	2113	„ 6	„ 9	7	3
1818	„ 31	„ 6	8	6	2116	„ 6	„ 11	7	5
1821	„ 31	„ 5	6	5					

Tags attached at Station B, Salmon Banks, Wash.

3007	July 21	July 26	10	5	3118	July 23	July 24	1	1
3009	„ 21	„ 29	1	8	3121	„ 23	„ 26	1	3
3014	„ 21	„ 29	1	8	3125	„ 23	„ 25	2	2
3015	„ 21	„ 24	9	3	3128	„ 23	„ 26	10	3
3024	„ 21	„ 25	10	4	3129	„ 23	„ 24	1	1
3028	„ 22	„ 24	2	2	3133	„ 23	„ 28	10	5
3036	„ 22	Aug. 6	7	15	3134	„ 23	„ 25	4	2
3037	„ 22	July 24	2	2	3143	„ 23	„ 29	10	6
3039	„ 22	„ 24	1	2	3146	„ 23	„ 28	10	5
3040	„ 22	„ 25	2	3	3147	„ 23	„ 29	9	5
3042	„ 22	„ 29	8	7	3148	„ 23	„ 29	6	6
3050	„ 22	„ 24	9	2	3149	„ 23	„ 23	10	1
3052	„ 22	„ 23	2	1	3150	„ 23	„ 26	8	3
3060	„ 22	„ 24	2	2	3153	„ 23	„ 31	2	8
3062	„ 22	„ 25	8	3	3158	„ 23	Aug. 1	2	9
3070	„ 23	„ 25	1	2	3160	„ 23	July 29	9	6
3075	„ 23	„ 24	1	2	3168	„ 24	„ 26	9	2
3079	„ 23	„ 25	1	2	3169	„ 24	„ 24	1	1
3086	„ 23	„ 27	10	4	3173	„ 24	„ 28	9	4
3087	„ 23	„ 26	6	3	3174	„ 24	„ 29	10	5
3088	„ 23	„ 25	9	2	3175	„ 24	„ 25	1	1
3089	„ 23	„ 26	2	3	3176	„ 24	„ 28	2	4
3093	„ 23	„ 26	9	3	3180	„ 24	Aug. 2	2	9
3103	„ 23	„ 25	9	2	3184	„ 24	July 26	9	2
3104	„ 23	„ 28	10	5	3185	„ 24	Aug. 2	10	9
3111	„ 23	„ 29	10	6					

* Beachy trap, Vancouver Island.

Table 2.—List of Tags returned—Continued.

TAGS ATTACHED AT STATION B, SALMON BANKS, WASH.—*Continued.*

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
3188	July 24	July 28	10	4	3399	July 31	Aug. 2	2	2
3189	„ 24	„ 30	6	6	3402	„ 28	July 30	9	2
3194	„ 24	„ 26	6	2	3403	„ 28	Aug. 1	7	4
3198	„ 24	Sept. 15	*	53	3404	„ 28	July 28	1	1
3199	„ 24	July 29	10	5	3405	„ 28	„ 28	1	1
3200	„ 24	„ 25	4	1	3409	„ 28	„ 28	1	1
3205	„ 24	Aug. 1	7	8	3410	„ 28	Aug. 2	10	5
3210	„ 24	July 25	6	1	3412	„ 28	„ 9	9	12
3216	„ 24	„ 25	1	1	3414	„ 28	July 30	7	2
3222	„ 25	Aug. 2	8	8	3415	„ 28	Aug. 4	2	7
3223	„ 25	July 30	10	5	3418	„ 28	July 30	9	2
3226	„ 25	„ 26	6	1	3423	„ 28	„ 30	9	2
3232	„ 25	„ 30	10	5	3425	„ 28	„ 29	1	1
3244	„ 25	Aug. 7	10	13	3428	„ 28	„ 31	8	3
3245	„ 25	„ 27	†	33	3432	„ 28	Aug. 8	8	11
3246	„ 25	„ 21	10	27	3433	„ 28	July 31	6	3
3251	„ 25	July 28	10	3	3434	„ 28	„ 30	10	2
3253	„ 25	„ 26	6	1	3437	„ 28	Aug. 5	1	8
3255	„ 25	Aug. 19	10	25	3441	„ 28	„ 3	10	6
3257	„ 25	July 29	10	4	3442	„ 28	July 30	9	2
3259	„ 25	Aug. 8	2	14	3443	„ 28	Aug. 13	9	16
3266	„ 25	„ 1	8	7	3444	„ 28	July 29	1	1
3268	„ 26	July 31	1	5	3445	„ 28	„ 29	1	1
3269	„ 26	„ 29	7	3	3446	„ 28	„ 30	2	2
3270	„ 26	„ 28	1	2	3448	„ 28	„ 31	8	3
3272	„ 26	„ 29	8	3	3450	„ 28	Aug. 1	9	4
3273	„ 26	„ 28	10	2	3451	„ 28	July 31	10	3
3274	„ 26	„ 28	1	2	3452	„ 28	„ 30	2	2
3275	„ 26	„ 28	1	2	3457	„ 31	Aug. 6	7	6
3278	„ 26	„ 30	10	4	3460	„ 31	„ 4	8	4
3281	„ 26	„ 31	‡	5	3461	„ 31	„ 3	8	3
3286	„ 26	„ 29	7	3	3462	„ 31	„ 6	8	6
3288	„ 26	„ 28	1	2	3463	„ 31	„ 30	‖	30
3290	„ 26	„ 29	1	3	3469	„ 31	„ 1	1	1
3294	„ 26	„ 29	9	3	3471	„ 31	„ 1	7	1
3295	„ 26	„ 28	1	2	3474	„ 31	„ 2	6	2
3297	„ 26	„ 31	1	5	3475	„ 31	„ 2	1	2
3298	„ 26	„ 26	10	1	3478	„ 31	„ 1	1	1
3299	„ 26	Aug. 18	8	23	3481	„ 31	„ 1	8	1
3301	„ 26	July 30	10	4	3484	„ 31	„ 5	2	5
3309	„ 26	„ 29	1	3	3486	„ 31	„ 1	2	1
3312	„ 26	Aug. 1	9	6	3487	„ 31	„ 2	8	2
3317	„ 26	„ 5	7	10	3490	„ 31	„ 4	7	4
3321	„ 26	Sept. 15	§	51	3495	„ 31	„ 2	8	2
3322	„ 26	July 30	10	4	3496	„ 31	„ 6	1	6
3326	„ 26	„ 29	1	3	3501	Aug. 1	„ 2	1	1
3328	„ 26	„ 29	9	3	3502	„ 1	„ 5	8	4
3329	„ 26	„ 31	1	5	3508	„ 1	„ 2	6	1
3330	„ 26	Aug. 22	9	27	3510	„ 1	„ ¶12	10	11
3335	„ 26	July 29	10	3	3513	„ 1	„ 4	8	3
3337	„ 26	„ 30	10	4	3514	„ 1	„ 2	1	1
3339	„ 26	Aug. 5	9	10	3518	„ 1	„ 15	10	14
3340	„ 26	July 30	9	4	3522	„ 1	„ 2	6	1
3350	„ 26	„ 31	6	5	3523	„ 1	„ 2	1	1
3351	„ 26	„ 29	9	3	3524	„ 1	„ 5	8	4
3354	„ 26	„ 30	9	4	3526	„ 1	„ 2	9	1
3355	„ 26	„ 29	8	3	3527	„ 1	„ 4	8	3
3356	„ 26	„ 31	10	5	3528	„ 1	„ 6	8	5
3357	„ 26	„ 28	9	2	3529	„ 1	„ 4	10	3
3358	„ 26	„ 29	10	3	3535	„ 1	„ 5	7	4
3361	„ 26	„ 29	6	3	3537	„ 1	„ 2	6	1
3366	„ 26	Aug. 8	9	13	3541	„ 1	„ 5	2	4
3367	„ 26	July 28	1	2	3544	„ 1	„ 5	9	4
3368	„ 26	Aug. 1	8	6	3545	„ 1	„ 2	6	1
3372	„ 26	July 30	10	4	3547	„ 1	„ 5	**	4
3375	„ 26	„ 31	10	5	3548	„ 1	„ 3	8	2
3377	„ 26	„ 31	8	5	3550	„ 1	„ 4	2	3
3378	„ 30	Aug. 4	7	5	3551	„ 1	„ 2	6	1
3382	„ 30	July 31	6	1	3552	„ 1	„ 4	10	3
3394	„ 30	Aug. 5	7	1	3553	„ 1	„ 7	8	6
3397	„ 31	„ 1	7	1	3554	„ 1	„ 4	7	3
3398	„ 31	„ 4	7	4	3555	„ 1	„ 4	8	3

* Four miles above Pitt Lake, 30 miles from Fraser River, 50 miles from ocean.
† Soda Creek, 280 miles above Mission.
‡ Devil's Run, 10 miles above Mission.
§ Four-mile Creek, Pitt River, 50 miles above Fraser River, 50 miles from ocean.
‖ Hagenson Slough, 30 miles above Fraser, 50 miles from ocean.
¶ The record is September 12th, but this is possibly a mistake, and the more probable date is August 12th, as tabulated.
** Fraser River, 5 miles above Yale, 60 miles above Mission.

Table 2.—List of Tags returned—Continued.

Tags attached at Station B, Salmon Banks, Wash.—*Concluded.*

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
3556	Aug. 1	Aug. 5	8	4	3699	Aug. 4	Aug. 8	9	4
3557	" 1	" 11	8	10	3700	" 4	" 6	8	2
3562	" 1	" 2	6	1	3702	" 4	" 5	6	1
3567	" 1	" 1	4	1	3703	" 4	" 9	10	5
3574	" 1	" 4	8	3	3704	" 4	" 6	7	2
3577	" 1	" 4	7	4	3705	" 4	" 7	10	3
3578	" 1	" 2	6	1	3711	" 4	" 6	2	2
3579	" 1	" 4	7	3	3713	" 4	" 6	7	2
3582	" 1	" 6	4	5	3714	" 4	" 9	9	5
3583	" 1	" 6	8	5	3715	" 4	" 6	2	2
3584	" 1	" 12	7	11	3718	" 4	" 19	10	15
3585	" 1	" 5	9	4	3721	" 4	" 7	9	3
3587	" 1	" 2	1	1	3722	" 4	" 9	10	5
3588	" 1	" 5	1	4	3727	" 4	" 7	8	3
3589	" 1	" 7	8	6	3728	" 4	" 7	9	3
3590	" 1	" 5	8	4	3730	" 4	" 6	2	2
3591	" 1	" 5	10	4	3735	" 4	" 6	7	2
3594	" 1	" 6	6	5	3737	" 4	" 5	7	1
3598	" 1	" 2	6	1	3739	" 4	" 5	1	1
3605	" 2	" 5	8	3	3741	" 4	" 6	7	2
3606	" 2	" 5	9	3	3742	" 4	" 8	8	4
3610	" 2	" 14	8	12	3743	" 4	" 7	6	3
3613	" 2	" 5	8	3	3744	" 4	Sept. 16	‡	43
3617	" 2	" 4	1	2	3746	" 4	Aug. 8	10	4
3619	" 2	" 5	7	3	3747	" 4	" 11	7	7
3624	" 2	" 5	1	3	3752	" 4	" 23	9	19
3625	" 2	" 7	8	5	3754	" 4	" 7	1	3
3630	" 2	" 4	1	2	3756	" 4	" 6	7	2
3632	" 2	" 4	1	2	3757	" 4	" 5	1	1
3633	" 2	" 7	8	5	3760	" 5	" 9	9	4
3634	" 2	" 7	9	5	3762	" 5	" 7	2	2
3635	" 2	" 4	1	2	3764	" 5	" 9	8	4
3637	" 2	" 14	2	12	3773	" 5	" 7	8	2
3639	" 2	" *17	10	15	3775	" 5	" 13	7	8
3642	" 2	" 5	9	3	3777	" 5	" 9	7	4
3643	" 2	" 5	9	3	3778	" 5	" 12	9	7
3644	" 2	" 5	7	3	3779	" 5	Sept. 20	§	46
3646	" 2	" 5	9	3	3780	" 5	Aug. 7	6	2
3648	" 2	" 5	8	3	3783	" 5	" 10	8	5
3653	" 2	" 5	7	3	3789	" 5	" 8	8	3
3658	" 2	" 6	10	4	3790	" 5	" 8	9	3
3662	" 2	" 6	10	4	3791	" 5	" 7	7	2
3663	" 2	" 7	8	5	3792	" 5	" 6	7	1
3667	" 4	" 5	1	1	3794	" 5	" 8	2	3
3670	" 4	" 10	8	6	3795	" 5	" 9	9	4
3672	" 4	" 6	6	2	3797	" 5	" 12	10	7
3673	" 4	" 6	2	2	3800	" 5	" 18	9	13
3677	" 4	" 6	2	2	3801	" 7	" 12	9	5
3678	" 4	" 9	8	5	3805	" 7	" 10	9	3
3680	" 4	" 20	10	16	3806	" 7	" 10	8	3
3682	" 4	" 7	8	3	3807	" 7	" 9	7	2
3685	" 4	" 7	8	3	3812	" 7	" 11	8	4
3687	" 4	" 7	8	3	3818	" 7	Sept. 3	‖	27
3688	" 4	" 18	9	14	3819	" 7	Aug. 14	9	7
3693	" 4	Sept. 17	†	44	3820	" 7	" 12	10	5
3694	" 4	Aug. 14	2	10	3826	" 7	" 13	10	6
3695	" 4	" 6	8	2	3829	" 7	" ¶18	10	11
3696	" 4	" 6	7	2	3835	" 7	" 10	8	3

Tags attached at Station C, Point Partridge, Wash.

1001	July 17	July 19	7	2	1023	July 17	July 20	4	3
1003	" 17	" 20	4	3	1030	" 17	" 22	1	5
1010	" 17	" 22	4	5	1031	" 17	" 21	10	4
1011	" 17	" 23	9	6	1036	" 17	" 20	1	3
1017	" 17	" 20	8	3	1037	" 17	" 25	1	8
1018	" 17	" 23	9	6	1038	" 17	Aug. 17	**	31
1019	" 17	" 22	1	5	1041	" 17	July 24	7	7

* The record is September 17th, but this is possibly a mistake, and the more probable date is August 17th, as tabulated.

† Birkenhead River, 25 miles above Lillooet Lake, 130 miles above Mission, Fraser River.

‡ Fraser River, 65 miles above Mission.

§ Birkenhead River, 25 miles above Lillooet Lake, 130 miles above Mission, Fraser River.

‖ Four-mile Creek, Pitt River, 30 miles above Fraser River, 50 miles from ocean.

¶ The record is September 18th, but this is possibly a mistake, and the more probable date is August 18th, as tabulated.

** Devil's Run, 10 miles above Mission, Fraser River.

Table 2.—List of Tags returned—Continued.

TAGS ATTACHED AT STATION C, POINT PARTRIDGE, WASH.—*Continued.*

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
1044	July 19	July 24	6	5	1307	July 26	Aug. 1	8	6
1050	" 19	" 22	9	3	1308	" 26	" 5	10	10
1052	" 19	" 24	6	5	1309	" 26	" 2	2	7
1055	" 19	" 22	2	3	1310	" 26	July 30	9	4
1057	" 19	" 22	7	3	1313	" 26	" 28	8	2
1058	" 19	" 22	3	3	1317	" 26	Aug. 2	9	7
1059	" 19	" 23	7	4	1320	" 26	" 11	8	16
1061	" 19	" 21	2	2	1322	" 26	" 5	10	10
1063	" 19	" 22	7	3	1328	" 26	July 30	6	4
1067	" 19	" 24	8	5	1330	" 26	" 30	1	4
1069	" 19	Aug. 2	8	14	1334	" 26	" 30	10	4
1075	" 19	July 22	2	3	1337	" 26	" 30	9	4
1078	" 19	" 22	2	3	1344	" 26	" 29	1	3
1079	" 19	" 24	6	5	1346	" 26	" 29	1	3
1080	" 19	" 22	8	3	1347	" 26	" 29	1	3
1085	" 19	" 22	2	3	1351	" 26	Aug. 4	7	9
1088	" 19	" 21	8	2	1353	" 26	" 1	8	6
1090	" 19	" 24	6	5	1354	" 26	" 1	8	6
1092	" 19	" 30	6	11	1355	" 26	" 1	10	6
1094	" 22	" 26	8	4	1357	" 26	" 9	6	14
1098	" 22	" 23	7	1	1360	" 26	" 1	2	6
1104	" 22	" 23	1	1	1363	" 26	" 12	7	17
1106	" 22	" 24	1	3	1366	" 26	" 4	7	9
1107	" 22	" 25	2	3	1368	" 26	July 29	7	3
1109	" 22	Aug. 12	10	21	1369	" 26	" 30	9	4
1111	" 22	July 24	1	2	1372	" 26	Aug. 16	9	27
1116	" 22	" 25	8	3	1373	" 26	" ‡18	10	23
1124	" 22	" 24	6	2	1374	" 26	July 30	8	4
1128	" 22	" 30	8	8	1375	" 26	" 29	1	3
1129	" 22	" 30	9	8	1377	" 26	Aug. 6	2	11
1130	" 22	" 28	10	6	1380	" 26	" 1	9	6
1132	" 22	" 29	1	7	1424	Aug. 6	" 7	2	1
1135	" 22	" 29	9	7	1438	" 6	" 11	7	5
1138	" 22	" 24	2	2	1548	" 7	" 9	1	2
1151	" 22	" 26	9	4	1559	" 7	" 14	8	7
1156	" 24	" 31	3	7	1567	" 7	" 7	2	1
1157	" 24	Aug. 8	2	15	1569	" 7	" 11	8	4
1163	" 24	" 10	*	17	1575	" 7	" 11	8	4
1165	" 24	" 1	8	8	1577	" 7	" 14	10	7
1167	" 24	July 29	10	5	1579	" 7	" 9	2	2
1169	" 24	" 30	2	6	1591	" 7	" 13	8	5
1173	" 24	Aug. 5	10	12	1598	" 7	" 13	4	6
1175	" 24	" 6	2	13	1604	" 7	" 16	6	9
1176	" 24	July 29	6	5	1609	" 7	" 13	8	6
1177	" 24	" 31	6	7	1617	" 7	" 9	7	2
1185	" 24	" 25	1	1	1628	" 7	" 11	8	4
1192	" 24	" 31	10	7	1639	" 7	" 13	9	5
1193	" 24	" 30	9	6	1673	" 9	" 16	8	7
1194	" 24	Aug. 10	*	17	1677	" 9	" 13	9	4
1196	" 24	July 29	1	5	1681	" 9	" 18	8	9
1197	" 24	" 29	9	5	1687	" 9	" 14	6	5
1199	" 24	" 31	6	7	1689	" 9	" 15	8	6
1205	" 24	" 30	2	6	1691	" 9	" 14	9	5
1207	" 24	Aug. 1	9	8	1695	" 9	" 13	8	4
1212	" 24	July 29	10	5	1704	" 9	" 12	6	3
1213	" 24	Aug. 7	10	14	1705	" 9	" 13	8	4
1221	" 24	July 30	8	6	1717	" 9	" 13	7	4
1223	" 24	" 31	9	7	1719	" 9	" 13	9	4
1228	" 24	" 31	1	7	1721	" 9	" 14	8	5
1229	" 24	" 29	8	5	1723	" 9	" 11	1	2
1231	" 26	Aug. 5	9	10	1724	" 9	" 12	6	3
1235	" 26	July 30	8	4	1732	" 9	" 12	7	3
1238	" 26	" 29	2	3	1735	" 9	" 22	9	13
1239	" 26	Aug. 18	9	23	1736	" 9	" 18	10	9
1241	" 26	July 29	2	3	1741	" 9	" 9	2	1
1242	" 26	Aug. 1	7	6	1743	" 9	" 13	8	4
1244	" 26	July 29	8	3	1746	" 9	" 18	8	9
1249	" 26	Aug. 6	†	11	1749	" 9	" 12	8	3
1251	" 26	July 29	8	3	1762	" 9	" 23	6	14
1264	" 26	" 30	8	4	1763	" 9	" 13	2	4
1269	" 26	" 31	6	5	1768	" 9	" 14	9	5
1278	" 26	Aug. 1	8	6	1769	" 9	" 13	8	4
1285	" 26	July 29	2	3	1773	" 13	" 15	8	2
1289	" 26	Aug. 18	10	23	1787	" 13	" 21	9	8
1290	" 26	July 29	8	3	1793	" 13	" 18	9	5
1293	" 26	Aug. 5	7	10	1796	" 13	" 13	2	1
1296	" 26	July 30	10	4					

* Ebey's Landing, below Point Partridge.
† Otter Point, Vancouver Island.
‡ The record is September 18th, but this is possibly a mistake, and the more probable date is August 18th, as tabulated.

Table 2.—List of Tags returned—Continued.

Tags attached at Station C, Point Partridge, Wash.—*Concluded.*

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
1807	Aug. 13	Aug. 17	9	4	1907	Aug. 13	Aug. 15	1	2
1812	„ 13	„ 14	2	1	1915	„ 13	„ 16	9	3
1820	„ 13	„ 19	8	3	1931	„ 14	„ 19	7	5
1835	„ 13	„ 14	2	1	1932	„ 14	„ 19	7	5
1846	„ 13	„ 16	4	3	1933	„ 14	„ 23	10	9
1851	„ 13	„ 16	8	3	1935	„ 14	„ 16	6	2
1853	„ 13	„ 18	8	5	1939	„ 14	„ 16	2	2
1854	„ 13	„ 16	8	3	1945	„ 14	Sept. 3	10	19
1856	„ 13	„ 14	1	1	1952	„ 14	Aug. 19	7	5
1865	„ 13	„ 15	1	2	1957	„ 14	„ 17	1	3
1867	„ 13	„ 19	7	6	1969	„ 14	„ 16	2	2
1878	„ 13	„ 16	1	3	1970	„ 14	„ 16	2	2
1887	„ 13	„ 22	9	9	1976	„ 14	„ 19	2	5
1889	„ 13	„ 15	2	2	1982	„ 14	„ 15	2	1
1891	„ 13	„ 16	8	3	1986	„ 14	„ 20	8	6
1897	„ 13	„ 15	8	2	1993	„ 14	„ 15	2	1
1899	„ 13	„ 19	7	6	1999	„ 14	„ 25	10	11
1900	„ 13	„ 15	2	2	2000	„ 14	„ 16	2	2

Tags attached at Station D, Lummi Island, Wash.

2002	July 19	July 30	9	11	2177	July 23	July 24	8	1
2003	„ 19	„ 22	8	3	2181	„ 24	Aug. 2	10	9
2013	„ 19	„ 22	8	3	2183	„ 24	July 25	9	1
2015	„ 19	„ 22	8	3	2185	„ 24	„ 29	9	5
2020	„ 19	„ 22	10	3	2186	„ 24	„ 25	8	1
2031	„ 19	„ 22	8	3	2189	„ 24	„ 28	9	4
2033	„ 19	„ 23	9	4	2190	„ 24	„ 26	9	2
2037	„ 19	Aug. 6	8	18	2201	„ 24	Aug. 6	9	13
2038	„ 19	July 21	8	2	2210	„ 24	„ 12	10	19
2039	„ 19	„ 22	8	3	2214	„ 24	July 26	9	2
2040	„ 19	„ 25	9	6	2216	„ 24	„ 25	9	1
2044	„ 19	„ 25	9	3	2221	„ 24	„ 29	10	5
2049	„ 19	„ 25	8	5	2226	„ 24	„ 26	9	2
2051	„ 19	Aug. 9	8	21	2231	„ 24	„ 29	9	5
2052	„ 19	July 22	8	3	2232	„ 24	„ 27	9	3
2055	„ 19	„ 22	7	3	2234	„ 24	„ 28	9	4
2057	„ 19	„ 23	9	4	2237	„ 24	„ 29	10	5
2061	„ 19	„ 22	8	3	2238	„ 24	„ 26	9	2
2063	„ 19	„ 24	8	1	2240	„ 24	„ 29	9	5
2065	„ 19	„ 22	8	3	2241	„ 24	„ 26	9	2
2069	„ 19	„ 22	8	3	2242	„ 24	„ 30	9	6
2072	„ 19	„ 21	9	2	2246	„ 24	„ 25	8	1
2073	„ 19	„ 24	8	5	2250	„ 24	„ 28	8	4
2075	„ 19	„ 24	7	5	2251	„ 24	Aug. 5	10	12
2078	„ 19	„ 22	8	3	2252	„ 28	„ 30	10	33
2079	„ 19	„ 22	9	3	2253	„ 28	„ 7	9	10
2082	„ 19	„ 23	9	4	2255	„ 28	July 29	9	1
2084	„ 19	Aug. 16	*	28	2257	„ 28	„ 30	8	2
2088	„ 23	July 26	8	3	2259	„ 28	Aug. 1	9	4
2090	„ 23	„ 24	8	1	2261	„ 28	July 30	8	2
2092	„ 23	„ 24	8	1	2265	„ 28	„ 29	8	1
2094	„ 23	„ 24	8	1	2268	„ 28	Aug. 26	‡	29
2095	„ 23	„ 24	8	1	2269	„ 28	July 31	8	3
2096	„ 23	„ 26	8	3	2270	„ 28	„ 30	9	2
2098	„ 23	„ 24	8	1	2271	„ 28	Aug. 1	10	4
2100	„ 23	Aug. 2	†	10	2280	„ 28	July 30	8	2
2103	„ 23	July 26	8	3	2282	„ 28	„ 30	9	2
2108	„ 23	„ 25	9	2	2285	„ 28	Aug. 11	10	15
2112	„ 23	„ 24	9	1	2286	„ 28	July 29	1	1
2122	„ 23	„ 24	8	1	2287	„ 28	„ 30	9	2
2125	„ 23	„ 26	8	3	2288	„ 28	„ 30	9	2
2137	„ 23	„ 24	8	1	2289	„ 28	Aug. 8	10	11
2147	„ 23	„ 25	8	2	2290	„ 28	July 30	8	2
2148	„ 23	„ 30	10	7	2291	„ 28	Aug. 1	9	3
2158	„ 23	„ 24	8	1	2295	„ 28	July 30	9	2
2160	„ 23	„ 24	9	1	2300	„ 28	„ 29	8	1
2161	„ 23	Aug. 13	10	21	2302	„ 28	„ 30	9	2
2166	„ 23	July 26	10	3	2304	„ 28	„ 29	8	1
2171	„ 23	„ 25	9	2	2310	„ 28	„ 29	1	1
2173	„ 23	„ 24	8	1	2312	„ 28	„ 30	9	2
2174	„ 23	„ 24	8	1	2313	„ 28	„ 29	8	1
2175	„ 23	„ 31	8	8	2314	„ 28	„ 30	9	2

* Soda Creek Canyon, 280 miles above Mission, Fraser River.
† Yale, 60 miles above Mission, Fraser River.
‡ Hell's Gate, 80 miles above Mission, Fraser River.

Table 2.—List of Tags returned—Continued.

TAGS ATTACHED AT STATION D, LUMMI ISLAND, WASH.—*Continued.*

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
2315	July 30	Aug. 30	*	31	2485	Aug. 5	Aug. 7	9	2
2319	„ 30	„ 1	9	2	2487	„ 5	„ 7	8	2
2323	„ 30	„ 2	8	3	2488	„ 5	„ 7	9	2
2324	„ 30	„ 1	9	2	2492	„ 5	„ 7	9	2
2328	„ 30	„ 1	9	2	2493	„ 5	„ 6	8	1
2330	„ 30	July 31	10	1	2495	„ 5	„ 6	8	1
2331	„ 30	Aug. 2	10	3	2497	„ 5	„ 6	8	1
2335	„ 30	„ 2	8	3	2501	„ 5	„ 6	9	1
2338	„ 30	July 31	10	1	2503	„ 5	„ ‡23	10	18
2344	„ 30	„ 30	8	1	2507	„ 5	„ 20	§	46
2346	„ 30	Aug. 2	2	3	2510	„ 5	„ 7	8	2
2347	„ 30	„ 1	8	2	2512	„ 5	„ 6	8	1
2349	„ 30	July 31	9	1	2515	„ 5	„ 9	9	4
2358	„ 30	Aug. 1	8	2	2516	„ 5	„ 6	9	1
2359	„ 30	„ 2	10	3	2517	„ 5	„ 7	9	2
2365	Aug. 2	„ 4	8	2	2518	„ 5	„ 6	8	1
2367	„ 2	„ 5	7	3	2522	„ 5	„ 7	8	2
2368	„ 2	„ 5	10	3	2523	„ 5	„ 6	8	1
2370	„ 2	„ 4	8	2	2529	„ 5	„ 7	8	2
2373	„ 2	„ 4	8	2	2530	„ 5	„ 6	8	1
2375	„ 2	„ 4	8	2	2531	„ 5	„ 7	8	2
2376	„ 2	„ 5	9	3	2535	„ 5	„ 6	9	1
2381	„ 2	„ 5	9	3	2539	„ 5	„ 7	8	2
2384	„ 2	„ 5	8	3	2541	„ 5	„ 6	8	1
2389	„ 2	„ 2	9	1	2542	„ 5	„ 8	8	3
2391	„ 2	„ 6	8	4	2544	„ 5	„ 7	8	2
2394	„ 2	„ 25	10	23	2546	„ 5	„ 7	8	2
2401	„ 2	„ 4	9	2	2547	„ 5	„ 6	8	1
2403	„ 2	„ 5	9	3	2548	„ 5	„ 8	10	3
2404	„ 2	„ 13	10	11	2549	„ 5	„ 8	8	3
2405	„ 2	„ 5	9	3	2551	„ 5	„ 6	8	1
2410	„ 2	„ 2	9	1	2552	„ 5	„ 8	10	3
2413	„ 2	„ 9	9	7	2554	„ 5	„ 7	8	2
2414	„ 2	„ 5	9	3	2556	„ 6	„ 7	9	1
2416	„ 2	„ 8	9	6	2557	„ 6	„ 8	8	2
2420	„ 4	„ 7	8	3	2558	„ 6	„ 9	10	3
2421	„ 4	„ 5	8	1	2559	„ 6	„ 6	9	1
2424	„ 4	„ 6	8	2	2560	„ 6	„ 7	9	1
2426	„ 4	„ 4	7	1	2566	„ 6	„ 9	10	3
2428	„ 4	„ 5	7	1	2569	„ 6	„ 9	9	3
2429	„ 4	„ †19	10	15	2570	„ 6	„ 6	9	1
2431	„ 4	„ 5	7	1	2574	„ 6	„ 9	9	3
2432	„ 4	„ 5	7	1	2575	„ 6	„ 9	10	3
2434	„ 4	„ 7	8	3	2576	„ 6	„ 16	‖	10
2435	„ 4	„ 6	8	2	2578	„ 6	„ 11	7	5
2436	„ 4	„ 6	9	2	2579	„ 6	„ 9	8	3
2437	„ 4	„ 5	8	1	2580	„ 6	„ 9	8	3
2438	„ 4	„ 5	8	1	2583	„ 6	„ 7	8	1
2439	„ 4	„ 4	7	1	2584	„ 6	„ 10	8	4
2440	„ 4	„ 5	9	3	2585	„ 6	„ 10	8	4
2441	„ 4	„ 5	8	1	2587	„ 6	„ 11	8	5
2442	„ 4	„ 16	8	2	2588	„ 6	„ 8	8	2
2443	„ 4	„ 6	9	2	2589	„ 6	„ 7	9	1
2444	„ 4	„ 5	9	1	2591	„ 6	„ 7	9	1
2445	„ 4	„ 5	8	1	2592	„ 6	„ 7	9	1
2449	„ 4	„ 5	8	1	2593	„ 6	„ 6	9	1
2453	„ 4	„ 5	8	1	2595	„ 6	„ 9	8	3
2455	„ 4	„ 5	8	1	2598	„ 6	„ 12	8	6
2456	„ 4	„ 6	8	2	2602	„ 6	„ 9	9	3
2457	„ 4	„ 6	8	2	2603	„ 6	„ 9	10	3
2459	„ 4	„ 7	9	3	2604	„ 6	„ 8	8	2
2464	„ 4	„ 5	9	1	2605	„ 6	„ 9	9	3
2465	„ 4	Sept. 3	10	30	2610	„ 6	„ 9	9	3
2466	„ 4	Aug. 6	9	2	2611	„ 6	„ 7	8	1
2469	„ 4	„ 5	8	1	2612	„ 6	„ 12	8	6
2471	„ 4	„ 6	8	2	2614	„ 6	„ 8	9	2
2472	„ 4	„ 5	9	1	2616	„ 6	„ 7	9	1
2474	„ 4	„ 6	9	2	2618	„ 6	„ 8	10	2
2475	„ 4	„ 6	8	2	2621	„ 6	„ 9	8	3
2476	„ 4	„ 6	8	2	2622	„ 6	„ 10	9	4
2478	„ 5	„ 6	8	1	2623	„ 6	„ 11	9	5
2482	„ 5	„ 7	8	2	2625	„ 6	„ 8	9	2

* Lytton, 110 miles above Mission, Fraser River.

† The record is September 19th, but this is possibly a mistake, and the more probable date is August 19th, as tabulated.

‡ The record is September 23rd, but this is possibly a mistake, and the more probable date is August 23rd, as tabulated.

§ Birkenhead River, 25 miles above Lillooet Lake, 130 miles above Mission, Fraser River.

‖ Strawberry Island, 50 miles above Mission, Fraser River.

Table 2.—List of Tags returned—Continued.

Tags attached at Station D, Lummi Island, Wash.—*Concluded.*

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
2627	Aug. 6	Aug. 7	8	1	2678	Aug. 7	Aug. 10	8	3
2628	„ 6	„ 7	9	1	2682	„ 7	„ 12	10	5
2629	„ 6	„ 11	10	5	2683	„ 7	„ 9	8	2
2630	„ 6	„ 8	9	2	2684	„ 7	„ 9	9	2
2631	„ 6	„ 11	7	5	2685	„ 7	„ 9	9	2
2633	„ 6	„ 9	9	3	2686	„ 7	„ 12	9	5
2634	„ 6	„ 15	9	9	2687	„ 7	„ 8	8	1
2635	„ 6	„ 7	9	1	2688	„ 7	„ 8	8	1
2636	„ 6	„ 8	8	2	2689	„ 7	„ 8	9	1
2642	„ 6	„ 8	9	2	2692	„ 9	„ 11	8	2
2645	„ 6	„ 7	8	1	2699	„ 9	„ 11	8	2
2646	„ 6	„ 8	8	2	2707	„ 9	„ 13	9	4
2648	„ 6	Sept. 19	*	44	2710	„ 9	Sept. 4	‡	26
2651	„ 7	Aug. 12	8	5	2713	„ 9	Aug. 16	8	7
2655	„ 7	„ 9	8	2	2717	„ 9	„ 12	9	3
2657	„ 7	„ 8	8	1	2718	„ 9	„ 14	10	5
2659	„ 7	„ 8	9	1	2719	„ 9	„ 12	10	3
2661	„ 7	„ 8	8	1	2720	„ 9	„ 15	8	6
2662	„ 7	„ 9	9	2	2722	„ 9	„ 13	9	4
2666	„ 7	„ 10	8	3	2726	„ 9	„ 14	9	5
2669	„ 7	„ 10	9	3	2728	„ 9	„ 12	10	3
2670	„ 7	„ 9	9	2	2733	„ 9	„ 11	8	2
2672	„ 7	„ 9	9	2	2734	„ 9	„ 11-13	9	3
2675	„ 7	„ 9	8	2	2736	„ 9	„ 14	9	5
2676	„ 7	„ 16	†	40	2737	„ 9	„ 19	7	10

Tags attached at Station E, Point Roberts, Wash.

4001	July 25	July 29	10	4	4249	July 29	Aug. 5	††	6
4007	„ 25	Aug. 4	7	11	4252	„ 29	„ 7	§§	9
4008	„ 25	July 26	10	1	4258	„ 29	„ 1	8	3
4012	„ 25	Aug. 5	§	11	4264	„ 30	„ 2	10	3
4025	„ 25	July 30	10	5	4267	„ 30	„ 2	10	3
4047	„ 25	„ 29	‖	4	4268	„ 30	„ 3	8	4
4065	„ 25	„ 28	10	3	4270	„ 30	July 30	10	1
4071	„ 25	„ 29	10	4	4271	„ 30	Aug. 2	10	3
4103	„ 26	Aug. 3	10	8	4274	„ 30	„ 5	10	6
4104	„ 26	July 29	10	3	4277	„ 30	July 31	10	1
4107	„ 26	„ 30	10	4	4279	„ 30	Aug. 16	10	17
4109	„ 26	„ 29	10	3	4283	„ 30	„ 5	10	6
4117	„ 26	„ 31	10	5	4284	„ 30	„ 6	10	7
4121	„ 26	„ 30	10	4	4286	„ 30	„ 20	‖‖	21
4122	„ 26	„ 28	10	2	4288	„ 30	„ 2	8	2
4129	„ 26	„ 29	10	3	4289	„ 30	„ 2	10	3
4138	„ 26	„ 29	10	3	4291	„ 30	„ ¶¶26	10	27
4142	„ 26	„ 28	10	2	4296	„ 30	„ 14	9	15
4150	„ 26	Aug. 5	¶	10	4300	„ 30	„ 4	8	5
4166	„ 29	„ 9	10	11	4305	„ 30	Sept. 13	***	45
4174	„ 29	„ 16	**	18	4315	„ 30	Aug. 6	9	7
4183	„ 29	„ 2	8	4	4317	„ 30	„ 2	10	3
4187	„ 29	„ 4	10	6	4327	„ 30	„ 30	†††	31
4196	„ 29	„ 12	10	14	4331	„ 30	„ 1	10	2
4198	„ 29	Sept. 12	††	45	4340	„ 30	„ 4	9	5
4203	„ 29	Aug. 2	8	4	4348	„ 30	July 30	10	1
4207	„ 29	July 30	10	1	4349	„ 30	„ 30	10	1
4209	„ 29	Aug. 5	10	7	4352	„ 30	Aug. 9	‡‡‡	10
4211	„ 29	July 30	10	1	4353	„ 30	July 30	9	1
4216	„ 29	Aug. 2	9	4	4356	„ 30	„ 31	10	1
4219	„ 29	July 31	10	2	4357	„ 30	Aug. 4	10	5
4220	„ 29	„ 31	10	2	4359	„ 30	„ 7	10	8
4221	„ 29	„ 30	10	1	4360	„ 30	„ 8	9	9
4246	„ 29	Aug. 1	9	3	4367	„ 30	„ 6	10	7

* Four miles above Pitt Lake, 30 miles from Fraser River, 50 miles from ocean.
† Near Spuzzum, 65 miles above Mission, Fraser River.
‡ Mountain Slough, above Pitt Lake, 30 miles from Fraser River, 50 miles from ocean.
§ Five miles above Yale, 65 miles above Mission, Fraser River.
‖ Mouth of Chilliwack River, 12 miles above Mission, Fraser River.
¶ Yale, 60 miles above Mission, Fraser River.
** Strawberry Island, 50 miles above Mission. Fraser River.
†† Portage Creek, foot of Anderson Lake, 170 miles above Mission.
‡‡ Twenty-seven miles above Mission, Fraser River.
§§ Devil's Run, 10 miles above Mission.
‖‖ Ten-mile House, above Harrison Lake, 75 miles above Mission.
¶¶ The record is September 26th, but this is possibly a mistake, and the more probable date is August 26th, as tabulated.
*** Chilcotin River, 235 miles above Mission.
††† Lillooet Bridge, 150 miles above Mission, Fraser River.
‡‡‡ Hell's Gate, 75 miles above Mission, Fraser River.

Table 2.—List of Tags returned—Continued.

TAGS ATTACHED AT STATION E, POINT ROBERTS, WASH.—*Continued.*

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
4368	July 30	Aug. 27	*	28	4573	Aug. 2	Sept. 5	10	3
4370	„ 30	Sept. 14	†	46	4595	„ 2	„ 7	10	5
4375	„ 31	„ 10	‡	41	4596	„ 2	„ 9	8	7
4376	„ 31	Aug. 15	10	15	4601	„ 2	„ 20	10	18
4381	„ 31	„ 7	8	7	4603	„ 2	„ 13	††	11
4383	„ 31	„ 1	10	1	4606	„ 2	„ 4	10	2
4384	„ 31	„ 6	10	6	4607	„ 2	„ 7	9	5
4389	„ 31	„ 21	10	21	4608	„ 2	„ 5	10	3
4392	„ 31	July 31	10	1	4609	„ 2	„ 6	9	4
4393	„ 31	Aug. 30	10	30	4610	„ 2	Sept. 11	‡‡	40
4402	„ 31	„ 5	9	5	4614	„ 2	„ 5	9	3
4403	„ 31	„ 1	10	1	4622	„ 2	„ 11	9	9
4404	„ 31	„ 4	7	4	4627	„ 2	„ 11	10	9
4405	„ 31	„ 11	10	11	4633	„ 5	„ 20	9	15
4407	„ 31	„ 15	10	15	4635	„ 5	„ 9	6	4
4415	„ 31	„ 2	10	2	4639	„ 5	„ 20	10	15
4417	„ 31	„ 5	10	6	4646	„ 5	„ 9	10	4
4423	„ 31	„ 1	10	1	4653	„ 5	Nov. 16	§§	103
4432	„ 31	„ 1	9	1	4654	„ 5	Aug. 11	10	6
4434	„ 31	July 31	10	1	4657	„ 5	„ 13	10	8
4436	„ 31	Aug. 30	10	30	4660	„ 5	„ 7	10	2
4438	„ 31	„ 11	7	11	4663	„ 5	„ 9	10	4
1446	„ 31	„ 2	10	2	4664	„ 5	„ 11	9	6
4447	„ 31	„ 21	10	21	4669	„ 5	„ 6	10	1
4454	„ 31	„ 6	8	6	4670	„ 5	„ 15	10	10
4461	„ 31	„ 7	10	7	4677	„ 5	„ 7	10	2
4464	„ 31	„ 7	10	7	4686	„ 5	„ 18	10	13
4467	„ 31	„ 5	8	5	4687	„ 5	„ 8	10	3
4468	„ 31	„ 16	8	16	4691	„ 5	„ 11	7	6
4474	„ 31	„ 20	10	20	4692	„ 5	„ 16	9	11
4476	„ 31	„ 5	9	5	4694	„ 5	Sept. 6	10	32
4478	„ 31	„ 9	10	9	4708	„ 5	Aug. 12	9	7
4480	„ 31	„ 5	10	5	4709	„ 5	„ 12	10	7
4481	„ 31	„ 7	10	7	4713	„ 5	Sept. 5	10	31
4482	„ 31	„ 28	§	28	4714	„ 5	Aug. 12	10	7
4483	„ 31	„ 2	10	2	4732	„ 5	„ 20	10	15
4485	„ 31	„ 5	9	5	4733	„ 5	„ 6	10	1
4486	„ 31	„ 2	10	2	4735	„ 5	„ 9	9	4
4487	„ 31	„ 5	8	5	4738	„ 5	„ 26	10	21
4488	„ 31	„ 1	10	1	4740	„ 5	„ 9	10	4
4489	„ 31	July 31	10	1	4751	„ 6	„ 9	10	3
4491	„ 31	Aug. 1	9	1	4753	„ 6	„ 12	9	6
4492	„ 31	„ 6	10	6	4754	„ 6	„ 6	10	1
4499	Aug. 1	„ 4	10	3	4756	„ 6	„ 18	10	12
4500	„ 1	„ ‖8	10	7	4759	„ 6	„ 30	10	24
4502	„ 1	„ 12	9	11	4760	„ 6	„ 16	10	10
4506	„ 1	„ 19	10	18	4765	„ 6	„ 8	10	2
4508	„ 1	„ 13	10	12	4773	„ 6	„ 12	10	6
4509	„ 1	„ 4	10	3	4776	„ 6	„ 20	10	14
4511	„ 1	Sept. 2	10	32	4777	„ 6	„ 7	10	1
4515	„ 1	„ 4	10	3	4780	„ 6	„ 11	9	5
4516	„ 1	„ 12	10	11	4784	„ 6	„ 9	9	3
4521	„ 1	„ 6	10	5	4790	„ 6	„ 18	10	12
4524	„ 1	„ 21	10	20	4791	„ 6	„ 7	10	1
4525	„ 1	„ 2	10	1	4796	„ 6	„ 19	10	13
4526	„ 1	„ 6	10	5	4799	„ 6	„ 26	10	20
4533	„ 1	„ 2	10	1	4800	„ 6	„ 13	10	7
4534	„ 2	„ 5	10	3	4801	„ 6	„ 6	10	10
4540	„ 2	„ 5	10	3	4803	„ 6	„ 7	10	1
4544	„ 2	„ 11	10	9	4808	„ 6	„ 8	10	2
4545	„ 2	„ 7	¶	5	4809	„ 6	„ 30	10	24
4547	„ 2	„ 5	**	3	4812	„ 6	„ 12	10	6
4553	„ 2	„ 4	10	2	4813	„ 6	„ 8	10	2
4556	„ 2	„ 5	10	3	4814	„ 6	„ 8	10	2
4558	„ 2	„ 4	10	2	4818	„ 6	„ ‖‖22	10	16
4560	„ 2	„ 12	8	10	4823	„ 7	„ 13	10	6
4562	„ 2	„ 8	10	6	4825	„ 7	„ 9	9	2
4569	„ 2	„ 4	10	2	4828	„ 7	„ 7	10	1

* Skookumchuck, on Lillooet River, 12 miles above Harrison Lake, 75 miles above Mission.
† Birkenhead River, 25 miles above Lillooet River, 130 miles above Mission, Fraser River.
‡ Portage Creek, foot of Anderson, 170 miles above Mission.
§ Hell's Gate, 80 miles above Mission.
‖ The record is September 8th, but this is possibly a mistake, and the more probable date is August 8th, as tabulated.
¶ Devil's Run, 10 miles above Mission, Fraser River.
** Three miles above Mission, Fraser River.
†† Trafalgar Flat, 50 miles above Mission, Fraser River.
‡‡ Samaquam, Lillooet River, 25 miles above Harrison Lake, 90 miles above Mission.
§§ Mouth of Seymour Creek, Burrard Inlet, at North Vancouver.
‖‖ The record is September 22nd, but this is possibly a mistake, and the more probable date is August 22nd, as tabulated.

Table 2.—List of Tags returned—Concluded.

Tags attached at Station E, Point Roberts, Wash.—*Concluded.*

Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.	Tag No.	Date Fish marked.	Date Fish recaught.	Region where taken.	Days en Route.
	1918.	1918.				1918.	1918.		
4830	Aug. 7	Aug. 16	*	9	74	Aug. 15	Sept. 24	‡	40
4831	„ 7	„ 7	10	1	75	„ 15	„ 21	‡	37
4833	„ 7	„ 10	10	3	83	„ 15	„ 15	‡	31
4836	„ 8	„ 18	10	10	84	„ 15	„ 10	10	26
4847	„ 8	„ 12	10	4	90	„ 16	„ 2	§	17
4861	„ 8	„ 8	10	1	100	„ 19	Aug. 19	10	1
4869	„ 8	„ 10	10	2	113	„ 19	„ 22	10	3
4870	„ 8	„ 19	†	11	126	„ 20	„ 21	10	1
4879	„ 8	„ 18	8	10	127	„ 20	„ 22	10	2
4883	„ 8	„ 12	9	4	130	„ 20	Sept. 5	10	16
4886	„ 8	„ 10	10	2	137	„ 20	Aug. 28	10	8
4896	„ 8	„ 12	10	4	140	„ 20	„ 22	10	2
4913	„ 8	„ 12	10	4	149	„ 20	„ 22	10	2
4914	„ 8	„ 9	10	1	151	„ 20	„ 22	10	2
4921	„ 8	„ 11	10	3	156	„ 21	„ 21	10	1
36	„ 15	„ 18	10	3	164	„ 21	Oct. 7	‡	47
38	„ 15	„ 16	10	1	165	„ 21	Aug. 21	10	1
72	„ 15	Sept. 20	‡	36	167	„ 21	„ ‖27	10	6

* American Bar, 50 miles above Mission, Fraser River.
† Trafalgar Flat, 50 miles above Mission, Fraser River.
‡ Birkenhead River, 25 miles above Lillooet Lake, 130 miles above Mission, Fraser River.
§ Samaquam, Lillooet River, 25 miles above Harrison Lake, 90 miles above Mission.
‖ The record is September 27th, but this is possibly a mistake, and the more probable date is August 27th, as tabulated.

Percentage of Returns.

Table 3 shows the percentage of returns from each day's marking at each station. The data from which the percentages were obtained are also given. In general the returns indicate that the marking was quite uniformly successful. This is especially true with that done at Stations B and D. The marking done at Station A suffered somewhat in efficiency for a few days at the time the change was made in the personnel, but otherwise is satisfactory. The records from Station E show a sudden diminution in the percentage of returns on August 8th and for the following three days on which fish were marked. No explanation can be given for this. As noted (note to Table 1, Station C), the accuracy of the August records for Station C is subject to considerable question, and the operator at this point has admitted reporting incorrectly the number of fish marked on August 6th. But 2 out of 164 reported marked on this date were recovered, a much lower percentage than was obtained from any other day's marking. These facts have thrown the record of marking done at this station during August so much under suspicion that it was considered necessary, in certain phases of the study, to disregard entirely the returns.

It is important to call attention to the fact that the figures given in Table 3 cannot be accepted as giving any adequate idea of the percentage of fish entering from the ocean which are caught while passing through the waters where commercial fishing is permitted. Several indeterminate factors must modify the percentage of returns to such an extent that, while they are reasonably comparable *inter se*, the actual figures give a much-distorted idea of the toll taken from the run as it is passing through the sound and river. Two of these factors are especially obvious, i.e.: (1) The figures as given here do not include all of the actual returns since some were omitted on account of faulty or incomplete data; the error from this factor, however, is not great, approximately 5 per cent.; (2) a much more important source of error is due to lost tags. There are no means of knowing just how many were taken and not turned in. Nor can anything more be learned as to the number of tags lost from the fish between the time they were attached and the time the fish were captured. Numerous reliable reports came to us of fish which showed a split in the tail-fin terminating in a hole similar to the one made with the leather-punch. Apparently the tags had in some manner become caught and pulled out. Another possibility is that some of the fish were unable to stand the operation necessary to the attachment of the tag, more particularly the attendant handling and removal from the water.

All of these factors would tend to increase the percentage of fish captured, but obviously there are no means for determining to what extent.

Table 3.—Number of Fish marked each Day, Total Number of Returns from each Day's Marking, and Percentages of Returns for each Station, 1918.

Date marked.	Station A.			Station B.			Station C.		
	Marked.	Returned.	Percentage returned.	Marked.	Returned.	Percentage returned.	Marked.	Returned	Percentage returned.
July 14	4	1	25	...	...	...	...	...	...
„ 17	...	...	...	...	...	...	43	14	30
„ 19	...	...	...	...	...	...	50	19	38
„ 21	46	16	35	25	5	20	...	...	...
„ 22	10	4	40	40	10	25	61	16	26
„ 23	20	2	10	95	27	28	...	...	...
„ 24	8	1	12	56	18	32	76	25	30
„ 25	56	4	7	50	13	26	...	...	...
„ 26	...	...	...	111	45	40	152	48	33
„ 27	98	16	16	...	...	...	...	...	...
„ 28	72	15	21	54	27	50	...	...	...
„ 30	99	20	20	117	3	18	...	...	...
„ 31	105	24	23	48	20	42	...	...	...
Aug. 1	77	12	16	104	46	45	...	...	...
„ 2	138	21	15	64	24	38	...	...	...
„ 4	64	8	12	94	44	48	...	...	...
„ 5	...	...	...	42	18	43	...	...	...
„ 6	34	3	9	...	...	...	164	2	1
„ 7	...	...	...	36	11	31	118	14	12
„ 9	...	...	...	...	...	...	105	25	24
„ 13	...	...	...	...	...	...	155	24	15
„ 14	...	...	...	...	...	...	76	16	21
Totals	831	147	17.7	836	311	37.5	1,000	203	20.2

Date marked.	Station D.			Station E.		
	Marked.	Returned.	Percentage returned.	Marked.	Returned.	Percentage returned.
July 19	85	28	33	...	...	...
„ 23	92	25	27	...	...	...
„ 24	74	23	31	...	...	...
„ 25	...	...	...	95	8	8
„ 26	...	...	...	70	11	16
„ 28	63	28	46	...	...	...
„ 29	...	...	...	93	18	19
„ 30	46	15	33	114	33	29
„ 31	...	...	...	122	41	34
Aug. 1	...	...	...	39	14	36
„ 2	56	20	36	97	24	25
„ 4	61	35	57	...	...	...
„ 5	78	35	45	113	27	24
„ 6	94	52	55	75	25	33
„ 7	41	21	51	16	6	37
„ 8	...	...	...	118	12	10
„ 9	47	16	34	...	...	...
„ 15	...	...	...	56	7	12
„ 16	...	...	...	12	1	8
„ 19	...	...	...	23	2	9
„ 20	...	...	...	31	7	23
„ 21	...	...	...	16	4	25
Totals	737	298	40.7	1,090	240	22

Total number marked 4,494
Total number returned 1,199
Percentage returned 26.8

Among the specimens listed in Table 2 the following were recorded as having been taken outside the limits of the regions indicated on the map:—

	Days out.
1 specimen, Burrard Inlet, marked August 5th, Station E	103
2 specimens, Ebey's Landing, marked July 24th, Station C	17
1 specimen, near Sooke, British Columbia, marked July 26th, Station C	11
2 specimens, near Sooke, British Columbia, marked July 27th, Station A	1-5

1 specimen, near Sooke, British Columbia, marked August 28th, Station A 4
4 specimens, near Sooke, British Columbia, marked July 20th, Station A . 2
1 specimen, near Sooke, British Columbia, marked August 2nd, Station A .. 2

These specimens from without the limits were so few that they have been omitted from further consideration. It seems probable that, with the exception of the specimens marked at Station A and taken near Sooke, these represent runs of sockeyes which were bound to some stream other than the Fraser River.

In the following tables separate consideration has been given to those fish which came from the tributaries of the Fraser and from the main river above Mission Bridge. The problems connected with the fish from these upper waters are sufficiently distinct from those connected with the fish taken by commercial fishermen to demand such separate treatment.

Table 4 gives the number of specimens returned (1) from the main commercial fishing-grounds, (2) from the Upper Fraser River, and (3) from outside the limits which we have set.

Table 4.—Number of Marked Fish taken in Numbered Districts of Puget Sound and Fraser River, Upper Fraser River, and outside these Boundaries.

Marking-station.	Total returned.	Number from		
		Main Districts.	Upper Fraser River.	Outside Limits.
A	147	136	3	8
B	311	301	10	..
C	203	199	1	3
D	298	289	9	..
E	240	212	27	1
Totals	1,199	1,137	50 †	12

Detailed Study of Returns from the Commercial Fishing Districts.

Two tables have been prepared for each of the marking-stations, presenting in detail the data obtained from the marking: First, a table showing for each day's marking the number and percentage of specimens recovered from each region and the average number of days required for the journey; second, a table showing the distribution of returns according to the region from which the return was reported and the number of days en route. This last is given as a matter of record and in order to show something of the range of variation underlying the average rates of progress as given in various other tables. It is upon the data given in these tables that the general discussions of the routes and rates of travel which immediately follow are based.

*Table 5.—Number and Percentage of Specimens from each Day's Marking at Station A taken in each Region and Average Number of Days en Route, 1918.**

Date marked.	Region.									
	1.		2.		4.		6.		7.	
	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.
July 14	..	..	1	5.0	..	..	..	..	..	..
„ 21	2	3.0	6	3.3	..	..	1	10.0	1	3.0
„ 22	1	1.0	1	6.0	..	..	..	..	..	..
„ 24	..	..	..	..	..	..	1	5.0	..	..
„ 25	2	6.5	..	..	..	..	..	..	..	..
„ 27	1	3.0	..	..	..	..	6	3.7	4	8.5
„ 28	1	1.0	..	..	..	..	5	6.4	3	5.3
„ 30	2	1.0	2	7.0	1	2.0	2	9.0	3	8.3
„ 31	..	..	1	5.0	..	..	3	5.3	8	7.5
Aug. 1	1	3.0	2	4.0	..	..	2	4.5	4	4.2
„ 2	1	2.0	2	2.5	..	..	3	4.0	6	3.5
„ 4	1	3.0	1	3.0	..	..	..	..	1	3.0
„ 6	..	..	..	..	..	..	..	..	2	4.0
Total	12	..	16	..	1	..	23	..	32	..
Averages†	..	2.8	..	4.1	..	2.0	..	5.7	..	5 8

* No specimens marked at Station A were recovered in Regions 3 and 5.
† Weighted mean.

Table 5.—Number and Percentage of Specimens from each Day's Marking at Station A taken in each Region and Average Number of Days en Route, 1918—Concluded.

Date marked.	Region.						Total marked.	Total returned.	Percentage returned.
	8.		9.		10.				
	Fish.	Days.	Fish.	Days.	Fish.	Days.			
July 14	..	..	..	..	..	..	4	1	25
„ 21	1	11.0	3	4.3	..	..	46	14	30
„ 22	..	..	..	..	2	6.0	10	4	40
„ 23	..	..	..	..	2	7.5	20	2	10
„ 24	..	..	..	..	..	..	8	1	12
„ 25	1	5.0	1	4.0	..	..	56	4	7
„ 27	..	..	1	4.0	1	5.0	98	13	13
„ 28	2	7.0	1	26.0	2	6.5	72	14	19
„ 30	2	10.0	4	6.0	..	..	99	16	16
„ 31	9	9.9	..	..	3	15.0	105	24	23
Aug. 1	2	5.0	..	..	1	8.0	77	12	16
„ 2	4	5.5	2	8.0	2	8.0	138	20	14
„ 4	3	4.3	1	7.0	1	33.0	64	8	12
„ 6	1	3.0	..	..	..	..	34	3	9
Total	25	..	13	..	14	..	831	136	16.3
Averages*	..	7.5	..	7.2	..	10.5	...	...	...

* Weighted mean.

*Table 6.—Distribution of Returns from Marking at Station A according to Region in which captured and Number of Days en Route.**

Days en Route.	Region.							
	1.	2.	4.	6.	7.	8.	9.	10.
1	4	..	..	1	1	..	..	..
2	2	2	1	1	2	..	2	..
3	4	6	..	3	6	1	..	..
4	1	1	..	6	4	4	3	1
5	..	4	..	5	3	6	1	2
6	..	1	..	2	3	3	1	1
7	..	2	..	..	4	4	3	1
8	..	..	..	..	3	1	..	4
9	..	..	..	..	2	..	1	1
10	1	..	..	2	1	..	..	1
11	..	..	..	..	2	1	1	..
12	..	..	..	3	1	1	..	..
13	..	..	..	..	..	1	..	..
14	..	..	..	..	..	1	..	..
16	..	..	..	..	..	1	..	..
18	..	..	..	..	..	1	..	2
26	..	..	..	..	..	..	1	..
33	..	..	..	..	..	..	..	1
Totals	12	16	1	23	32	25	13	14

* No specimens marked at Station A were recovered in Regions 3 and 5.

*Table 7.—Number and Percentage of Specimens from each Day's Marking at Station B taken in each Region and Average Number of Days en Route, 1918.**

Date marked.	Region. 1.		2.		4.		6.		7.	
	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.
July 21	2	8.0	..	..	..	..	..	..	..	..
„ 22	1	2.0	5	2.0	..	..	..	..	1	15.0
„ 23	6	1.8	4	5.5	1	2.0	2	4.5	..	..
„ 24	3	1.0	2	6.5	1	1.0	3	3.0	1	8.0
„ 25	..	..	1	14.0	..	..	2	1.0	..	..
„ 26	12	3.0	..	..	..	..	2	4.0	3	5.3
„ 28	7	2.0	3	3.7	..	..	1	3.0	2	3.0
„ 30	..	..	..	..	..	..	1	1.0	2	5.5
„ 31	4	2.5	3	2.7	..	..	1	2.0	5	3.2
Aug. 1	5	1.6	2	3.5	2	3.0	9	1.4	5	5.0
„ 2	5	2.2	1	12.0	..	..	..	..	3	3.0
„ 4	4	1.2	6	3.3	..	..	3	2.0	8	2.5
„ 5	..	..	2	2.5	..	..	1	2.0	4	3.7
„ 7	..	..	..	..	..	..	..	..	1	2.0
Totals	49	..	29	..	4	..	25	..	35	..
Averages†	..	2.4	..	4.2	..	2.2	..	2.3	..	4.4

Date marked.	Region. 8.		9.		10.		Total marked.	Total returned.	Per-centage returned.
	Fish.	Days.	Fish.	Days.	Fish.	Days.			
July 21	..	..	1	3.0	2	4.5	25	5	20
„ 22	2	5.0	1	2.0	..	..	40	10	25
„ 23	1	3.0	5	3.6	8	4.4	95	27	28
„ 24	..	..	3	2.7	4	5.7	56	17	30
„ 25	2	7.5	..	..	7	11.7	50	12	24
„ 26	5	8.0	10	7.5	11	3.5	111	43	39
„ 28	3	5.7	7	5.7	4	4.0	54	27	50
„ 30	..	..	..	..	..	..	17	3	18
„ 31	6	3.0	..	..	..	..	48	19	40
Aug. 1	14	5.0	3	3.0	5	7.0	104	45	44
„ 2	7	5.1	5	3.4	3	8.0	64	24	38
„ 4	9	3.4	6	8.0	6	8.7	94	42	45
„ 5	4	3.5	5	6.2	1	7.0	42	17	41
„ 7	3	3.3	3	5.0	3	7.3	36	10	28
Totals	56	..	49	..	54	..	836	301	36
Averages†	..	4.7	..	5.4	..	6.3	...	...	...

* No specimens marked at Station B were recovered in Regions 3 and 5.
† Weighted mean.

*Table 8.—Distribution of Returns from Marking at Station B according to Region in which captured and Number of Days en Route.**

Days en Route.	Region.							
	1.	2.	4.	6.	7.	8.	9.	10.
1	20	2	2	13	4	1	1	2
2	15	13	1	4	9	6	10	2
3	6	4	..	4	7	21	13	8
4	1	2	..	..	6	8	9	14
5	3	1	1	2	1	7	4	14
6	1	..	..	2	2	5	2	5
7	..	1	..	..	1	2	2	1
8	3	1	..	..	2	1	..	..
9	..	2	..	..	..	..	..	1
10	..	1	..	..	1	1	1	..
11	..	..	..	..	1	1	..	1
12	..	1	..	..	..	1	1	..
13	..	..	..	..	..	1	2	1
14	..	1	..	..	..	..	1	..
15	..	..	..	..	1	..	..	2
16	..	..	..	..	..	..	1	1
19	..	..	..	..	..	..	1	..
23	..	..	..	..	..	1	..	..
25	..	..	..	..	..	..	..	1
27	..	..	..	..	..	..	1	1
Totals	49	29	4	25	35	56	49	54

* No specimens marked at Station B were recovered in Regions 3 and 5.

*Table 9.—Number and Percentage of Specimens from each Day's Marking at Station C taken in each Region and Average Number of Days en Route, 1918.**

Date marked.	Region.											
	1.		2.		3.		4.		6.		7.	
	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.
July 17	4	5.2	..	..	..	..	3	4.3	..	..	2	4.5
„ 19	..	..	5	2.8	1	3.0	..	..	5	6.2	2	3.5
„ 22	4	3.0	2	2.5	..	..	..	..	1	2.0	1	1.0
„ 24	3	4.3	4	10.0	1	7.0	..	..	4	4.2	..	..
„ 26	5	3.2	6	5.5	..	..	..	..	3	7.0	6	9.0
Aug. 6	..	..	1	1.0	..	..	..	..	..	..	1	5.0
„ 7	1	2.0	2	1.5	..	..	1	6.0	1	9.0	1	2.0
„ 9	1	2.0	2	2.5	..	..	..	..	4	6.2	2	3.5
„ 13	4	2.0	5	1.4	..	..	1	3.0	..	..	2	6.0
„ 14	1	3.0	7	2.1	..	..	..	..	1	2.0	3	5.0
Totals	23	..	34	..	2	..	5	..	19	..	20	..
Averages†	..	3.0	..	3.8	..	5.0	..	4.4	..	5.7	..	5.6

Date marked.	Region.						Total marked.	Total returned.	Percentage returned.
	8.		9.		10.				
	Fish.	Days.	Fish.	Days.	Fish.	Days.			
July 17	1	3.0	2	6.0	1	4.0	43	13	30.0
„ 19	5	5.4	1	3.0	..	..	50	19	38.0
„ 22	3	5.0	3	6.3	2	13.5	61	16	26.0
„ 24	2	7.0	4	6.5	5	8.7	76	23	30.0
„ 26	13	7.3	7	8.1	7	10.9	152	47	33.0
Aug. 6	..	..	..	..	..	..	164	2	1.0
„ 7	6	5.0	1	5.0	1	7.0	118	14	12.0
„ 9	10	5.5	5	6.2	1	9.0	105	25	24.0
„ 13	7	3.0	5	5.8	..	..	155	24	15.5
„ 14	1	6.0	..	..	3	13.0	76	16	21.0
Totals	48	..	28	..	20	..	1,000	199	19.9
Averages†	..	5.6	..	6.5	..	9.8	...	...	...

* No specimens marked at Station C were taken in Region 5.
† Weighted mean.

*Table 10.—Distribution of Returns from Marking at Station C according to Region in which captured and Number of Days en Route.**

Days en Route.	Region.								
	1.	2.	3.	4.	6.	7.	8.	9.	10.
1	3	8	..	..	1	1	..	..	..
2	6	9	..	..	2	2	4	..	..
3	7	7	1	1	2	3	12	2	..
4	1	1	..	2	2	2	11	7	3
5	3	1	..	1	8	4	4	5	2
6	..	3	..	1	..	3	8	3	2
7	2	1	1	..	..	1	1	3	3
8	1	1	..	..	..	..	2	4	..
9	..	..	..	..	1	2	2	1	2
10	..	..	..	..	..	1	..	1	1
11	..	1	..	..	1	..	..	..	..
12	..	..	..	..	..	..	..	..	1
13	..	1	..	..	..	..	..	1	..
14	..	..	..	..	2	..	1	..	1
15	..	1	..	..	..	..	..	..	..
16	..	..	..	..	..	..	2	..	..
17	..	..	..	..	..	1	..	..	..
21	..	..	..	..	..	..	..	1	1
23	..	..	..	..	..	..	1	..	4
Totals	23	34	2	5	19	20	48	28	20

* No specimens marked at Station C were recovered in Region 5.

*Table 11.—Number and Percentage of Specimens from each Day's Marking at Station D taken in each Region and Average Number of Days en Route, 1918.**

Date marked.	Region.												Total Number marked.	Total Number returned.	Percentage returned.
	1.		2.		7.		8.		9.		10.				
	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.			
July 19	..	..	..	..	2	4.0	16	5.1	8	4.6	1	3.0	85	27	32
„ 23	..	..	..	..	..	..	17	1.9	4	1.5	3	10.3	92	24	26
„ 24	..	..	..	..	..	..	3	2.0	15	3.8	5	10.2	74	23	31
„ 28	2	1.0	..	..	..	..	9	1.4	12	2.8	4	15.7	63	27	43
„ 30	..	..	1	3.0	..	..	5	2.2	4	1.7	4	2.0	46	14	30
Aug. 2	..	..	..	..	1	3.0	6	2.5	10	2.8	3	12.3	56	20	36
„ 4	..	..	..	..	5	1.0	19	1.6	9	1.6	2	22.5	61	35	57
„ 5	..	..	..	..	..	..	23	1.6	8	1.9	3	8.0	78	34	44
„ 6	..	..	..	..	2	5.0	18	2.8	24	2.3	6	3.2	94	50	53
„ 7	..	..	..	..	..	..	10	1.8	9	2.2	1	5.0	41	20	49
„ 9	..	..	..	..	1	10.0	5	3.8	6	4.0	3	3.7	47	15	32
Totals	2	..	1	..	11	..	131	..	109	..	35	..	737	289	39
Average†	..	1.0	..	3.0	..	3.3	..	2.5	..	2.7	..	8.5	..	..	..

* No specimens marked at Station D were recovered in Regions 3, 4, 5, and 6.
† Weighted mean.

*Table 12.—Distribution of Returns from Marking at Station D according to Region in which captured and Number of Days en Route, 1918.**

Days en Route.	Region.						Days en Route.	Region.					
	1.	2.	7.	8.	9.	10.		1.	2.	7.	8.	9.	10.
1	2	..	5	47	28	2	12	..	..	..	..	..	1
2	..	..	..	39	38	1	13	..	..	..	..	1	..
3	..	1	2	28	19	12	15	..	..	..	..	..	2
4	..	..	..	6	10	2	18	..	..	..	1	..	1
5	..	..	3	4	7	5	20	..	..	..	..	..	1
6	..	..	..	3	2	..	21	..	..	..	1	..	1
7	..	..	..	1	1	1	23	..	..	..	..	..	1
8	..	..	..	1	..	..	30	..	..	..	..	..	1
9	..	..	..	..	1	..	33	..	..	..	..	..	1
10	..	..	1	..	1	1							
11	..	..	..	..	1	2	Totals	2	1	11	131	109	35

* No specimens marked at Station D recovered in Regions 3, 4, 5, and 6.

*Table 13.—Number and Percentage of Specimens from each Day's Marking at Station E taken in each Region and Average Number of Days en Route, 1918.**

Date marked.	Region. 6. Fish.	6. Days.	7. Fish.	7. Days.	8. Fish.	8. Days.	9. Fish.	9. Days.	10. Fish.	10. Days.	Total marked.	Total returned.	Percentage returned.
July 25	..	..	1	11.0	..	..	..	..	5	3.4	95	6	6
„ 26	..	..	..	..	..	..	..	..	10	3.7	70	10	14
„ 29	..	..	..	..	3	3.7	2	3.5	9	5.0	93	14	15
„ 30	..	..	..	..	3	4.0	5	7.4	19	5.5	114	27	23
„ 31	..	..	2	7.5	5	7.8	5	3.4	27	8.3	122	39	32
Aug. 1	..	..	..	..	..	..	1	11.0	13	9.3	39	14	36
„ 2	..	..	..	..	2	8.5	4	5.2	14	4.9	97	20	21
„ 5	1	4.0	1	6.0	..	..	5	8.6	19	9.8	113	26	23
„ 6	..	..	..	..	..	..	3	4.7	22	7.9	75	25	33
„ 7	..	..	..	..	..	..	1	2.0	4	2.7	16	5	31
„ 8	..	..	..	..	1	10.0	1	4.0	9	3.4	118	11	10
„ 15	..	..	..	..	..	..	..	..	3	10.0	56	3	5
„ 16	..	..	..	..	..	..	..	..	..	..	12	..	..
„ 19	..	..	..	..	..	..	..	..	2	2.0	23	2	8
„ 20	..	..	..	..	..	..	..	..	7	4.7	31	7	23
„ 21	..	..	..	..	..	..	..	..	3	2.7	16	3	19
Totals	1	..	4	..	14	..	27	..	166	..	1,090	212	19.5
Averages†	..	4.0	..	8.0	..	6.4	..	5.8	..	6.7	...	...	...

* No specimens marked at Station E were recovered in Regions 1, 2, 3, 4, and 5.
† Weighted mean.

*Table 14.—Distribution of Returns from Marking at Station E according to Region in which captured and Number of Days en Route.**

Days en Route.	Region. 6.	7.	8.	9.	10.	Days en Route.	Region. 6.	7.	8.	9.	10.
1	..	..	..	3	34	15	..	..	..	2	4
2	..	..	..	1	25	16	..	..	1	..	2
3	..	..	2	3	24	17	..	..	..	..	1
4	1	1	3	4	10	18	..	..	..	..	2
5	..	..	3	6	7	20	..	..	..	..	3
6	..	1	1	2	12	21	..	..	..	..	3
7	..	..	2	2	10	24	..	..	..	..	2
8	..	..	..	..	4	26	..	..	..	..	1
9	..	..	..	2	3	27	..	..	..	..	1
10	..	..	2	..	3	30	..	..	..	..	2
11	..	2	..	2	3	31	..	..	..	..	1
12	..	..	..	..	3	32	..	..	..	..	2
13	..	..	..	..	2						
14	..	..	..	..	2	Totals	1	4	14	27	166

* No specimens marked at Station E were recovered in Regions 1, 2, 3, 4, and 5.

It was hoped that much more detailed information as to the migration up the Fraser River might be presented, and to that end the river and the waters of the Strait of Georgia around the mouth of the river had been divided into twenty regions, each comprising about five miles of the river or off shore about the mouths. The returns from Canada were at first studied on this basis, but it finally became clear that the subdivisions were much too small to give results of any significance. These twenty regions were then divided into seven, as follows:—

Region 10. Banks off the mouth of the South Arm and Canoe Pass.
Region 11. South Arm and Canoe Pass up as far as Deas Island.
Region 12. South Arm from Deas Island to New Westminster.
Region 13. Banks off the mouth of the North Arm.
Region 14. North Arm.
Region 15. Fraser River from New Westminster to the mouth of Pitt River.
Region 16. Fraser River from the mouth of Pitt River to Mission Bridge.

Table 15 gives the number of specimens which were marked at each of the marking-stations recovered from each of these regions, and the average number of days en route. It is apparent from this that even with this increase in the size of the regions no significant and consistent difference in the length of time required to reach the different regions appears, and for the purposes of statistical analysis it was necessary to consider all of the returns from the main Canadian waters as constituting a single group, and to combine Regions 10 to 16 into one region, 10. It is much to be regretted that the data are not such as to make possible a reliable estimate of the rate of travel in the river itself. Whether this is due to the manner of collecting and recording the data cannot be stated. Although these records from Canadian waters do not admit of detailed analysis, when combined as a single group they agree well with the results obtained from American waters.

Table 15.—Number of Specimens marked at each Station recovered in each Region in Canadian Waters, including the Fraser River to Mission Bridge only, and Average Number of Days en Route.

	Station.					Total Fish.	Average Number Days en Route.*
	A.	B.	C.	D.	E.		
Region 10:							
Fish	3	15	7	11	35	66	...
Days	7.0	6.3	10.3	8.0	6.8	...	7.2
Region 11:							
Fish	8	27	8	15	77	134	...
Days	13.5	6.0	6.9	9.1	6.1	...	6.9
Region 12:							
Fish	2	5	2	3	11	23	...
Days	6.5	5.6	13.5	12.3	5.2	...	7.0
Region 13:							
Fish	...	...	...	3	11	14	...
Days	...	...	...	2.7	9.9	...	8.4
Region 14:							
Fish	...	1	...	1	18	19	...
Days	...	5.0	...	1.0	6.8	...	6.7
Region 15:							
Fish	...	2	2	2	4	9	...
Days	...	5.5	14.5	3.0	9.7	...	9.1
Region 16:							
Fish	1	4	1	...	10	16	...
Days	5.0	7.8	10.0	...	6.0	...	6.6
Total fish	14	54	20	35	166	289	...
Average number days en route*	10.5	6.1	9.8	8.3	6.6	...	7.1

* Weighted mean.

In Table 16 is shown the total number of individuals marked at each station which were taken in each region, together with the average time en route. This combines the totals and averages developed in Tables 5 to 14.

*Table 16.—Number of Specimens marked at each Station taken in each Region and Average Number of Days en Route.**

	Region.									
	1.		2.		3.		4.		6.	
	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.
A	12	2.8	16	4.1	..	..	1	2.0	23	5.7
B	49	2.4	29	4.2	..	..	4	2.2	25	2.3
C	23	3.0	34	3.8	2	5.0	5	4.4	19	5.7
D	2	1.0	1	3.0	..	..	..	..	..	..
E	..	..	..	..	..	..	..	..	1	4.0
Totals	86	..	80	..	2	..	10	..	68	..

* No specimens were taken in Region 5.

Table 16.—Number of Specimens marked at each Station taken in each Region and Average Number of Days en Route—Concluded.

	Region.								Total.
	7.		8.		9.		10.		
	Fish.	Days.	Fish.	Days.	Fish.	Days.	Fish.	Days.	
A	32	5.8	25	7.5	13	7.2	14	10.5	136
B	35	4.4	56	4.7	49	5.4	54	6.3	301
C	20	5.6	48	5.6	28	6.5	20	9.8	199
D	11	3.3	131	2.5	109	2.7	35	8.5	289
E	4	8.0	14	6.4	27	5.8	166	6.7	212
Totals	102	..	274	..	226	..	289	..	1,137

Routes taken by Fraser River Sockeyes through Puget Sound.—Tables 17 and 18 show in complementary ways the distribution of returned fish according to the station at which they were marked and the region in which they were taken. Table 17 gives the percentages of the total returns from each station which were taken in each region and Table 18 the percentages of the total returns from each region which were marked at each station. The returns from Regions 3, 4, and 5 are practically negligible. It is quite obvious that the great majority of the fish, on entering the Sound through the Strait of Juan de Fuca, pass across to Washington Sound, and especially the southern shores of the southern islands of the San Juan Archipelago (Region 1) and the western shore of Whidbey Island (Region 2); 8.8 per cent. of the returned fish which were marked at Soeke were taken in Region 1 and 11.8 per cent. in Region 2.

*Table 17.—Percentages of Recovered Fish from each Marking-station which were taken in each Region.**

	Region.								
	1.	2.	3.	4.	6.	7.	8.	9.	10.
A	8.8	11.8	..	0.7	17.0	23.5	18.4	9.5	10.3
B	16.2	9.6	..	1.3	8.3	11.6	18.9	16.2	17.9
C	11.4	16.8	1	2.5	9.9	9.9	24.3	13.8	10.4
D	0.7	0.4	..	..	..	3.8	45.3	37.7	12.1
E	..	..	..	..	0.5	1.9	6.6	12.7	78.3

* No specimens were recovered in Region 5.

*Table 18.—Percentage of Recovered Fish from each Region which were marked at each Station.**

	Region.								
	1.	2.	3.	4.	6.	7.	8.	9.	10.
A	14.0	20.0	..	10	33.3	31.4	9.1	5.8	4.8
B	57.0	36.2	..	40	36.3	34.4	20.6	21.6	18.6
C	26.7	42.5	100	50	29.0	19.6	17.7	12.4	7.2
D	2.3	1.3	..	..	..	10.8	47.5	48.3	12.1
E	..	..	..	..	1.4	3.8	5.1	11.9	57.3

* No specimens were recovered in Region 5.

There is apparently considerable interchange of fish between Regions 1 and 2, as is evidenced by the fact that 9.6 per cent. of the returned fish marked at Station B, located in Region 1, were taken in Region 2, and that 11.4 per cent. of the fish marked at Station C, in Region 2, were taken in Region 1. From the region of Washington Sound a very few fish pass northward through Haro Strait (Region 4), but the proportion must be small compared with those passing through Rosario Strait and on up through the Strait of Georgia. The apparent proportions may, however, be modified by the fact that there are many more traps in Rosario Strait than in Haro

Strait. The few fish taken in Haro Strait came from Stations A, B, and C, as would be expected. Only two specimens were taken in Deception Pass, both marked at Station C. No fish are recorded as having been taken in the central channels of the San Juan Archipelago.

From the southern part of the Strait of Georgia (locally designated the Gulf of Georgia) the fish pass Point Roberts and enter Canadian territorial waters. Very soon thereafter they must enter the river, especially through Canoe Pass and the main mouth of the South Arm, and begin their journey up the river to the spawning-grounds.

In summarizing, the route followed by the very great majority of the salmon entering the Strait of Juan de Fuca and bound for the Fraser River may be stated as follows: Across Washington Sound to the "Banks" south of the San Juan Islands and to the western shore of Whidbey Island; from here northward through Rosario Strait to the Strait of Georgia, past Point Roberts to the mouths of the Fraser River. There is no evidence to indicate that this route is varied in different parts of the season.

As might be expected, this route is well indicated by the location of the various trap-sites. The approximate number of traps in the various regions of Puget Sound for which licences were issued in 1918 is as follows:*—

Region 1	14	Region 7	11
„ 2	20	„ 8	40
„ 3	13	„ 9	39
„ 4	11		
„ 5	4	Total	178
„ 6	26		

In addition to the above, there are six traps located on the Canadian side of the Straits of Juan de Fuca, on Vancouver Island, eleven scattering traps along the southern shore of these straits, and twenty-nine in Admiralty Straits, chiefly between Admiralty Bay and Double Bluff. There are also a few in Hood Canal and that part of the sound extending south past Seattle, Saratoga Passage, and Padilla Bay. The ones listed above are those of chief concern here.

There is apparently only a very low degree of correlation between the number of traps and the number of marked fish taken in any particular region. In Table 19 the six regions from which most of the returns came have been arranged in the order of the number of traps located in each. Then is given, for each region, the percentages of fish marked at Stations A and B which were recaptured in the respective regions. No correlation is apparent between the number of traps and the returns from Station A. There seems to be a distinct correlation in the case of the returns from Station B (especially if Region 6 is omitted), but the correlation is not well proportioned.

Table 19.—Correlation between Number of Traps in Various Regions and Number of Marked Fish taken in those Regions.

Region.	Number of Traps.	Percentage of Returns from Stations.	
		A.	B.
7	11	4.12	4.98
1	14	1.44	5.86
2	20	1.95	6.23
6	26	2.87	3.28
9	39	1.82	8.31
8	40	3.35	8.62

In a few instances a retrograde migration has apparently taken place and the fish have travelled away from rather than toward the mouth of the Fraser River. It is possible that faulty data may account for this, especially in such extreme cases as those fish marked at Station D and reported taken in Regions 1 and 2; or it may be that these are not Fraser River fish, but are sockeyes bound for some other stream.

* Based upon licences issued by the Fish and Game Commission of the State of Washington.

Rate of Migration.—A number of the preceding tables give, variously grouped, the average number of days required to pass from each marking-station to each region. Tables 5, 7, 9, 11, and 13 show the total range of variation in this regard for each station, and the general averages for each station are shown in Table 16. From the last-mentioned table it is apparent that, as would be expected, the time en route usually increases as the distance between the station and the regions where the fish were recovered increases. Those fish which were captured in the same region in which they were marked—such, for instance, as were marked at Station B and recovered from Region 1—have evidently been slow to resume the migration after the marking. Forty-nine specimens marked at Station B were taken in Region 1 after being out an average of 2.4 days. From Station C thirty-four specimens were taken in Region 2 after an interval of 3.8 days. Eleven specimens from Station D were taken in Region 7 after an average of 3.3 days, and twenty-seven specimens from Station E were taken in Region 9 after 5.8 days. It seems quite clear that, in the case of fish which have been recaptured comparatively close to the point at which they were liberated, the rate of progress is slower than that of fish taken a greater distance from the marking-station. Also, as may be seen from Table 16, in cases where a retrograde migration has taken place the rate of progress has usually been slow. These occurrences may possibly be due to some slight injury, or other unfavourable result, due to the handling attendant upon tagging. It may also be due to inaccurate data. In either case it would seem justifiable, when estimating the normal rate of progress through the sound, to consider only those cases of forward migration in which the fish have travelled a reasonably long distance from the station at which they were marked, say not less than twenty miles.

In the case of the Canadian records it will be noted that the correlation between the distance travelled and the time en route is very low. The average time required to pass from Station E, at Point Roberts, into the Fraser River is 6.6 days. This would indicate a much slower rate of migration here than in other parts of the sound. In order to throw additional light upon this point, the difference between the time required for fish marked at Stations A, B, C, and D to reach the vicinity of Point Roberts (Region 9) and that which elapsed before the fish from these same stations were taken in Canadian waters has been calculated as follows:—

	Days.
Station A	3.3
„ B	0.9
„ C	3.3
„ D	5.6
Average (simple mean)	3.27

This indicates a rate of progress between Point Roberts and the Fraser River over twice as rapid as that indicated solely by the results of the marking at Point Roberts, and one agreeing much better with the results obtained from the American records.

The previous tables have shown the rate of travel as the number of days required to pass from the marking-station to the various regions of the sound. In order to make these figures comparable, the rate in miles per day has been calculated for each instance. This has been done by simply dividing the distance travelled by the time required to make the journey. Table 20 gives the distances from each marking-station to each of the established regions of the sound. These distances were measured, by means of an ordinary map measure, from the marking-station to approximately the centre of the region in question. The most direct route possible was chosen.

*Table 20.—Distances on Puget Sound from Marking-stations to Regions where Fish were taken.**

Station.	Region.	Miles.	Station.	Region.	Miles.	Station.	Region.	Miles.
A	1	35.0	C	1	15.5	E	1	62.0
	2	47.5		2	...		2	59.5
	3	57.0		3	15.5		3	62.5
	4	45		4	35.0		4	35
	5	52.5		5	23.5		5	35
	6	60		6	20		6	45
	7	71		7	33		7	35
	8	83		8	45		8	20.5
	9	92.5		9	59.5		9	...
	10	122.5		10	89.5		10	30
B	1	...	D	1	33.5			
	2	15		2	28			
	3	21.5		3	29.5			
	4	17.5		4	51.5			
	5	10		5	41.5			
	6	21.5		6	13			
	7	33.5		7	...			
	8	47.5		8	11.5			
	9	62		9	27.5			
	10	92		10	57.5			

* As it is obvious that the majority of the fish pass through Rosario Strait, the distances, wherever applicable, have been measured over this route.

*Table 21.—Number of Specimens marked at each Station taken in each Region and Rate of Progress in Miles per Day.**

	A.	B.	C.	D	E.		A.	B.	C.	D.	E.
Region 1:						Region 7:					
Fish	12	49	23	2	..	Fish	32	35	20	11	4
Rate	12.5	..	5.2	33.5	..	Rate	12.2	7.6	5.9	..	4.4
Region 2:						Region 8:					
Fish	16	29	34	1	..	Fish	25	56	48	131	14
Rate	11.5	3.6	..	9.3	..	Rate	11.1	10.1	8.0	4.6	3.2
Region 3:						Region 9:					
Fish	..	..	2	..	..	Fish	13	49	28	109	27
Rate	..	..	3.1	..	..	Rate	12.8	11.5	9.1	10.2	..
Region 4:						Region 10:					
Fish	1	4	5	..	..	Fish	14	54	20	35	166
Rate	22.5	8.0	8.0	..	..	Rate	11.7	14.6	9.1	6.8	4.5
Region 6:											
Fish	23	25	19	..	1						
Rate	10.5	9.3	3.5	..	11.2						

* No specimens were taken in Region 5.

Table 21 gives the results of these calculations of the rate in miles per day, together with the number of individuals on which the calculations are based. From this has been calculated the mean rate of travel.* In doing this all cases have been omitted which were based on (1) less than ten individuals, (2) a distance travelled of less than twenty miles, and (3) a retrograde migration relative to the mouth of the Fraser River. This has been done to exclude, as nearly as possible, all abnormal figures. With these exclusions there remain nineteen categories on which to base the final conclusions as to the rate of migration. The data for these nineteen categories are given separately in the following table:—

* This and other similar means have been computed by use of the "harmonic mean" recommended by Yule (An Introduction to the Theory of Statistics), Rugg (Statistical Methods Applied to Education), and others, for the calculation of mean rates based on units of work. The harmonic mean is defined by Rugg as "the reciprocal of the arithmetic mean of the reciprocals of the individual measures of the series."

Table 22.—Rate of Progress in the Nineteen Categories containing the Most Reliable Data.

Station marked.	Region where captured.	Distance travelled.	Specimens.	Rate per Day.
		Miles.	Number.	Miles.
A	1	35.0	12	12.5
	2	47.5	16	11.5
	6	60	23	10.5
	7	71	32	12.2
	8	83	25	11.1
	9	92.5	13	12.8
	10	122.5	14	11.7
B	6	21.5	25	9.3
	7	33.5	35	7.6
	8	47.5	56	10.1
	9	62	49	11.5
	10	92	54	14.6
C	7	33	20	5.9
	8	45	48	8
	9	59.5	28	9.1
	10	89.5	20	9.1
D	9	27.5	109	10.2
	10	57.5	35	6.8
E	10	30	166	4.5

Calculated from these figures the mean rate of migration is 7.8 miles per day. If the Canadian records are omitted, the rate is 9.7 miles per day.

Greene,* in his study of the migration of salmon (Chinook, silver salmon, and steelhead) in the Columbia River, obtained results quite different from these. He estimates that from thirty to forty days are usually required for the process of acclimatization to fresh water, during which time the fish work back and forth with the tides. After entering water which is wholly fresh he estimates the rate of travel of silver salmon and steelhead at 6.36 to 7.50 miles per day, although he concedes that this is only about one-third of the rate of travel as estimated by men engaged in the fishing industry and seems to imply that their figures are probably more reliable than his own. Greene's figures should be accepted with considerable caution on account of the comparatively few individuals marked and the fact that three species were represented and all combined to give his final results. The sockeye-tagging experiment has produced no evidence indicating that the migration is especially retarded during the passage from salt to fresh water. As may be seen from Table 15, there is no great difference in the time required to pass from American waters to the Fraser River, just within the mouths, and that required to pass above New Westminster, where the water is entirely fresh. Furthermore, as will be seen later, in the case of fish taken on or near the spawning-grounds in the tributaries, the time elapsed since marking averages between thirty and forty days, the time given by Greene as required for the process of acclimatization. It may be concluded either that Greene's results are wholly unreliable or that the migration of sockeye is quite different from that of the species studied by him, which is, of course, entirely possible. The rate of migration of the quinnat (Chinook) salmon of the Sacramento River as given by Rutter† is much more nearly in accord with the results of this sockeye study. He estimates the rate of progress through brackish water to average seven or eight miles per day and that through fresh water to be between fifteen and twenty miles per day. These figures apply only to the spring run on the Sacramento River. The migration of the fall run is considerably slower, averaging but four to five miles per day through the fresh water. Greene's observations were, of course, made upon fall-run fish.

A further analysis of data has shown some interesting variations in the rate of migration. A calculation of the mean rate of migration from each marking-station indicates that the rate of travel decreases as the fish approach nearer the mouth of the Fraser as follows: Station B, 10.5; Station C, 7.9; Station D, 9.1; Station E, 4.5.

* Greene, Charles W.: The Migration of Salmon in the Columbia River. Bulletin U.S. Bureau of Fisheries for 1909, Vol. XXIX., pages 129-148. Washington, 1911.

† Rutter, Cloudsley: Natural History of the Quinnat Salmon. Bulletin U.S. Fish Commission for 1902, Vol. XXII., pages 65-142. Washington, 1904.

Finally the rates of migration for different parts of the season have been calculated. The data given in Tables 1 and 2 were first condensed into quartiles and then into halves, and the rate of travel in miles per day was calculated for each of these. The positions of the quarter points determining the quartiles were based on the number of fish marked, not on the number returned. In adopting a central point on which to separate the halves it was rather arbitrarily determined to consider all fish marked during July as belonging to the first half and all those marked during August as belonging to the second half. It is more convenient to think of the halves as separated in this manner, and the central point separating the fish marked into halves comes sufficiently close to August 1st to warrant the division on this basis. These calculations have not been made for Stations C and E. The inaccuracies in the marking record at Station C would have made such treatment valueless. In the case of Station E, over 78 per cent. of the fish recovered were taken in Canadian waters. Inasmuch as the authors were unable to make a detailed analysis of the Canadian records, it has seemed best not to attempt too detailed an analysis of the records obtained from the marking at Station E.

Table 23.—Rate in Miles per Day in Different Quartiles—Returns from Station A.

Quartiles.	Region. 1.		2.		6.		7.		8.		9.		10.		Total Fish.	Average Rate*
	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.		
First	6	9.2	8	12.2	6	13.9	3	11.3	2	10.4	5	22.0	5	19.1	35	13.0
Second	3	35.0	2	6.8	9	8.6	8	9.9	4	9.8	5	9.2	2	18.8	33	10.0
Third	1	11.6	4	12.8	6	12.5	13	11.4	13	10.0	2	11.6	5	10.4	44	11.1
Fourth	2	14.0	2	15.8	2	15.0	8	19.7	6	17.3	1	13.2	2	5.7	23	14.5

* Harmonic mean.

Table 24.—Rate in Miles per Day in Different Halves—Returns from Station A.

Halves.	Region. 1.		2.		6.		7.		8.		9.		10.		Total Fish.	Average Rate*
	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.		
First	9	12.1	11	10.3	18	9.8	19	9.7	15	8.9	10	13.0	10	13.6	92	10.5
Second	3	13.0	5	14.8	5	14.3	13	18.7	10	17.3	3	12.0	4	8.6	43	14.8

* Harmonic mean.

Table 25.—Rate in Miles per Day in Different Quartiles—Returns from Station B.

Quartiles.	Region. 6.		7.		8.		9.		10.		Total Fish.	Average Rate.*
	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.		
First	4	5.1	2	2.9	3	11.0	10	20.0	14	18.4	33	11.0
Second	6	9.3	5	7.6	9	6.2	14	10.3	21	14.4	55	9.9
Third	11	14.3	18	10.8	25	10.3	7	12.6	6	14.6	68	11.5
Fourth	4	10.8	15	9.6	19	13.2	18	10.3	13	13.3	69	11.3

* Harmonic mean.

Table 26.—Rate in Miles per Day in Different Halves—Returns from Station B.

Halves.	Region.										Total Fish.	Average Rate.*
	6.		7.		8.		9.		10.			
	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.		
First	12	7.7	14	6.6	19	8.8	27	12.1	36	16.1	108	10.5
Second	13	12.6	21	8.6	37	10.8	22	11.3	18	13.4	112	10.9

* Harmonic mean.

Table 27.—Rate in Miles per Day in Different Quartiles—Returns from Station D.

Quartiles.	Region.						Total Fish.	Average Rate.*	Average Rate (for Regions 9 and 10 only).
	8.		9.		10.				
	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.			
First	33	3.7	13	8.1	5	6.7	51	4.6	7.6
Second	18	6.4	30	8.6	13	6.5	61	7.3	7.8
Third	46	6.8	27	13.1	7	3.9	80	7.5	8.8
Fourth	34	4.4	39	11.0	10	16.4	83	7.0	11.8

* Harmonic mean.

Table 28.—Rate in Miles per Day in Different Halves—Returns from Station D.

Halves.	Region.						Total Fish.	Average Rate.*
	8.		9.		10.			
	Fish.	Rate.	Fish.	Rate.	Fish.	Rate.		
First	50	4.3	43	8.3	17	6.2	110	5.6
Second	81	5.5	66	11.5	18	7.4	165	7.2

* Harmonic mean.

In the case of the quartiles, the indications are that the rate is more rapid in the first than in the second quartile, and that the rates in the third and fourth quartiles are successively more rapid than in the second. This does not appear clearly in the results from Station D, especially when the returns from Region 8 are included. Omitting the returns from Region 8 (which is deemed legitimate, considering the comparatively short distance travelled, just twenty miles from Station D to the centre of Region 8) brings the results more nearly in accord with those obtained from Stations A and B, the only disagreement being in the rate during the first quartile. This is, in the case of Station D, slightly less, rather than greater, than the rate in the second quartile.

It seems not unlikely that the difference in rates of travel shown in the different quartiles may be explained as indicating racial differences existing in the fish composing different parts of the run. Gilbert* has demonstrated that the Fraser River run is composed of a number of distinguishable races, each bound to a different spawning region. The assumption that these races may have different rates of migration while passing through the waters of the sound does not seem to be a difficult one to accept.

* Gilbert, Charles H.: Contributions to the Life History of the Sockeye Salmon. Report, Commissioner of Fisheries for the Province of British Columbia for 1917, Paper No. 4, pages Q33-80. Victoria, 1918.

In the case of the halves, the results from all three stations are in complete agreement, indicating that the rate during the second half is distinctly more rapid than during the first half.

In connection with the above determination of the rate of progress through Puget Sound, it must be borne in mind that the rates are undoubtedly lower than they should be. This necessarily follows when it is considered that seldom less than one day, and frequently three or four days, elapses between the times when the traps are lifted and the fish reported. Again, the fish may spend some time in the hearts and pot of the trap before entering the spiller, from which they may be taken at the next lift. A fish entering the trap immediately after it has been lifted would not be reported before the next day at the earliest, thus adding at least one day to the actual time required to make the journey from the marking-station. If traps were uniformly lifted at twenty-four-hour intervals, twelve hours could with safety be subtracted from the average number of days en route and the rate calculated accordingly. The authors' knowledge on this point, however, is not sufficient to warrant such treatment. It would undoubtedly be a step in the right direction, but would tend to give an opinion that the rates have been fully corrected, which would be quite unwarranted by the facts. It is possible that the error involved is within the limits of error dependent upon other factors.

Returns from Tributary Streams and the Fraser River above Mission Bridge.

Returns were obtained from various sections of the Fraser River watershed which have not been included in the regions indicated on the map. These sections may be indicated as follows:—

	Specimens.
Main river, 3 to 27 miles above Mission	7
Main river, near Hope, Yale, Hell's Gate, and Spuzzum	16
Main river at Lytton and Lillooet	2
Main river at Soda Creek	2
Pitt River	6
Harrison Lake system, between Harrison and Lillooet Lakes	5
Harrison Lake system, Birkenhead River	9
Seton Lake system, Portage Creek	2
Chilcotin River	1

The complete data concerning these returns are given in Table 29. The mean dates on which the fish captured in each of the above districts have been calculated and appear in the summary. This was done in order to see, if possible, when the fish bound to the different tributaries were to be found in Puget Sound. We have suggested above the possibility of a segregation in time of the races demonstrated by Dr. Gilbert.

Table 29.—Returns of Specimens marked at each Station from Fraser River other than the Main River from the Mouth to Mission Bridge, 1918.

Section.	A.			B.			C.			D.			E.			Summary.		
	Date marked.	Date taken.	Days en Route	Date marked.	Date taken	Days en Route	Date marked.	Date taken.	Days en Route	Date marked.	Date taken.	Days en Route	Date marked.	Date taken.	Days en Route	Fish taken	Mean Date.	Average Days en Route
3-27 miles above Mission main river	.....	.....	.....	July 26	July 31	5	July 17	Aug. 17	31	.....	.....	.....	July 29	Aug. 4	6	7	July 27	9.3
													July 29	Aug. 7	9			
													Aug. 2	Aug. 5	3			
													Aug. 2	Aug. 7	5			
													July 25	July 29	4			
Near Hope, Yale, Spuzzum, and Hell's Gate main river	July 21	Aug. 1	11	Aug. 1	Aug. 5	4	.....	.....	.....	July 23	Aug. 2	10	July 25	Aug. 5	11	16	July 30	16.3
	July 21	Aug. 26	36	Aug. 4	Aug. 16	12	.....	.....	.....	July 28	Aug. 26	29	July 26	Aug. 5	10			
										Aug. 6	Aug. 16	10	July 29	Aug. 17	18			
										Aug. 7	Sept. 16	40	July 30	Aug. 9	10			
													July 31	Aug. 28	28			
													Aug. 2	Aug. 13	11			
													Aug. 7	Aug. 16	9			
													Aug. 8	Aug. 19	11			
Lytton and Lillooet Bridge, main river	.....	.....	.....	.....	.....	.....	.....	.....	.....	July 30	Aug. 30	31	July 30	Aug. 30	31	2	July 30	31.0
Soda Creek, main river	.....	.....	.....	July 25	Aug. 27	33	.....	.....	.....	July 19	Aug. 16	28	.....	.....	.....	2	July 22	30.5
Pitt River, 5 miles above Pitt Lake	.....	.....	.....	July 24	Sept. 15	53	.....	.....	.....	Aug. 6	Sept. 19	44	.....	.....	.....	6	Aug. 3	38.5
				July 26	Sept. 15	51				Aug. 9	Sept. 4	26						
				July 31	Aug. 30	30												
				Aug. 7	Sept. 3	27												
Between Harrison and Lillooet Lakes	July 27	Sept. 14	49	.....	.....	.....	.....	.....	.....	.....	.....	.....	July 30	Aug. 20	21	5	Aug. 2	31.0
													July 30	Aug. 27	28			
													Aug. 2	Sept. 11	40			
													Aug. 16	Sept. 2	17			
Harrison and Lillooet Lakes, Birkenhead River	.....	.....	.....	Aug. 4	Sept. 17	44	.....	.....	.....	Aug. 5	Sept. 20	46	July 30	Sept. 14	46	9	Aug. 10	41.4
				Aug. 5	Sept. 20	46							Aug. 15	Sept. 15	31			
													Aug. 15	Sept. 20	36			
													Aug. 15	Sept. 21	37			
													Aug. 15	Sept. 24	40			
													Aug. 21	Oct. 7	47			
Seton and Anderson Lakes, Portage Creek	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	July 29	Sept. 12	45	2	July 30	43.0
													July 31	Sept. 10	41			
Chilcotin River	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	July 30	Sept. 13	45	1	July 30	45.0
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50	.....	.....

The data here presented are quite too fragmentary to afford a basis for more than the most tentative conclusions; but the following points are suggested:—

(1.) The fish which go farthest up the main river before turning into the tributary in which they are to spawn run earlier in the season.

(2.) The main bulk of the fish which pass up the main river past Hope are to be found in Puget Sound at the height of the season, the latter part of July and early in August.

(3.) The fish entering the lower tributaries, Pitt River and the Harrison Lake system, come largely from those fish constituting the last half of the run.

In the event that it were deemed desirable to stop commercial fishing for part of the season, it would seem that the first part should be selected, as the indications are that there is a larger proportion of the up-river fish in the first half of the run, and these are the fish which have suffered more severely as a result of the disaster of 1913.

SUMMARY.

(1.) The experiment of tagging adult sockeye salmon in Puget Sound was initiated in an effort to determine the routes and rates of migration of Fraser River sockeye in passing through the waters where commercial fishing is permitted.

(2.) During July and August, 1918, numbered silver or aluminium buttons were attached to 4,494 adult sockeyes. Of these, 1,199 were later recovered and data as to time and places of capture secured.

(3.) The route most commonly followed passes from the Strait of Juan de Fuca across Washington Sound to the Salmon Banks and Whidbey Island, then through Rosario Strait and the southern part of the Strait of Georgia, past Point Roberts to the mouths of the Fraser River.

(4.) The rate of migration as determined by the data for American waters is approximately ten miles per day.

(5.) The migration is more rapid during the last half than during the first half of the season.

PACK OF BRITISH COLUMBIA SALMON, SEASON, 1918.

COMPILED FROM DATA FURNISHED THE DEPARTMENT BY THE B.C. SALMON CANNERS' ASSOCIATION.

Names.	Sockeyes.	Red Springs.	White Springs.	Chums.	Pinks.	Cohoes.	Blue backs and Steelheads	GRAND TOTALS (Cases).
FRASER RIVER DISTRICT—								
B.C. Packers' Association	8,462	4,472	11,471	10,696	779	14,177	599	50,656
J. H. Todd & Sons	611	615	884	2,605	33	3,816	416	8,980
J. H. Todd & Sons (Esquimalt)	2,848	....	....	....	....	....	....	2,348
Glen Rose Canning Co., Ltd.	883	267	862	2,079	....	3,586	416	7,677
Great West Packing Co., Ltd.	792	667	998	1,995	461	4,717	677	10,307
M. DesBrisay & Co.	874	727	1,646	819	4	1,329	....	5,399
Gosse-Millerd Packing Co., Ltd.	1,500	1,162	2,978	7,238	154	2,839	36	15,907
Defiance Packing Co., Ltd.	294	5,154	429	18,355	2,241	1,625	....	28,098
C.L. Packing Co., Ltd.	918	291	1,447	5,455	19	29	....	9,068
St. Mungo Canning Co., Ltd.	1,034	494	1,188	5,857	....	5,142	909	13,715
Eagle Harbour Packing Co., Ltd.	212	379	428	3,735	2,836	1,211	1,750	10,551
Liverpool Canning Co., Ltd.	725	342	1,476	10,866	185	932	8	14,534
Canadian Fishing Co., Ltd.	544	622	1,046	16,515	11,676	708	....	31,111
Totals	19,697	15,192	24,853	86,215	18,388	40,111	4,395	208,851
SKEENA RIVER DISTRICT—								
B.C. Packers' Association	24,526	3,050	2,916	2,743	34,907	12,113	1,709	81,964
Anglo B.C. Packing Co., Ltd.	19,917	2,262	1,173	2,469	26,181	4,258	667	56,927
J. H. Todd & Sons	8,016	3,838	456	487	12,861	9,319	....	34,977
Kildala Packing Co., Ltd.	9,438	746	330	118	13,355	631	358	24,976
B.C. Canning Co., Ltd.	12,257	957	124	194	9,070	2,139	362	25,103
Skeena River Com. Co., Ltd.	5,729	826	426	679	11,543	1,475	367	21,045
Cassiar Packing Co., Ltd.	10,118	695	314	124	8,256	799	347	20,653
Wallace Fisheries, Ltd.	14,384	1,402	....	419	15,506	2,377	526	34,614
Gosse-Millerd Packing Co., Ltd.	7,823	995	152	552	10,640	1,879	366	22,407
Canadian Fish & Cold Stor. Co., Ltd.	6,944	897	115	2,810	8,730	1,513	6	21,015
Port Edward Fisheries, Ltd.	4,170	345	822	11,978	10,678	2,256	286	30,535
Totals	123,322	16,013	6,828	22,573	161,727	38,759	4,994	374,216
RIVERS INLET DISTRICT—								
B.C. Packers' Association	14,626	367	152	990	10,771	4,671	....	31,577
Anglo B.C. Packing Co., Ltd.	5,282	....	121	23	2,018	56	....	7,500
J. H. Todd & Sons	4,939	....	....	144	3,962	2,688	....	11,733
B.C. Canning Co., Ltd.	7,295	235	48	....	2,332	21	....	9,931
Kildala Packing Co., Ltd.	5,951	131	40	1,345	3,492	2,919	....	13,878
Wallace Fisheries, Ltd.	6,153	93	39	4,181	2,129	833	....	13,428
Provincial Canning Co., Ltd.	3,800	....	18	27	3,906	210	....	7,961
McTavish Fisheries, Ltd.	5,355	131	34	19	932	676	....	7,147
Totals	53,401	957	452	6,729	29,542	12,074	....	103,155
NASS RIVER DISTRICT—								
B.C. Packers' Association	4,776	894	659	3,503	3,454	2,039	392	15,717
Anglo B.C. Packing Co., Ltd.	7,208	511	549	11,262	18,569	2,580	425	41,104
Kincolith Fisheries, Ltd.	4,427	634	563	11,354	6,014	4,718	405	28,115
M. DesBrisay & Co.	2,608	191	....	8,071	15,888	6,048	13	32,819
Western Salmon Packers, Ltd.	2,142	97	49	2,315	8,366	1,278	70	14,317
Portland Fisheries, Ltd.	655	5	....	3,863	6,915	398	....	11,836
Totals	21,816	2,332	1,820	40,368	59,206	17,061	1,305	143,908
VANCOUVER ISLAND DISTRICT—								
Anglo B.C. Packing Co.	285	....	375	12,164	10,479	4,813	....	28,116
J. H. Todd & Sons	....	4,300	1,016	348	302	5,546	....	11,512
Wallace Fisheries, Ltd.	1,258	6,758	373	21,904	2,049	8,433	....	40,775
Quathiaski Canning Co., Ltd.	606	215	310	5,038	18,055	3,806	....	28,030
Western Packers, Ltd.	179	....	....	481	9,103	3,375	23	13,161
C.L. Packing Co., Ltd.	....	....	....	13,719	2,430	258	231	16,638
Preston Packing Co., Ltd.	....	1,285	570	1,694	10,856	2,117	....	16,522
Clayquot Sound Canning Co., Ltd.	2,607	1,465	41	1,425	....	368	....	5,906
Nanaimo Canning & Packing, Ltd.	....	39	30	25,303	657	838	122	26,989
Redonda Canning & Cold Storage Co.	....	189	337	9,377	2,001	....	1,126	13,530
Gulf Islands Fishing & Can. Co., Ltd.	121	90	46	8,719	724	2,073	1,489	13,262
Sidney Canning Co., Ltd.	1,174	1,394	671	13,147	320	5,769	....	22,475
Lummi Bay Packing Co., Ltd.	13	1,326	290	81,890	59	....	1,224	84,802
Nootka Packing Co., Ltd.	....	8,399	805	20,206	....	2,796	....	32,206
Defiance Packing Co., Ltd.	....	....	....	24,753	....	....	....	24,753
Puntledge Canning Co., Ltd.	....	....	....	10,598	....	540	....	11,138
Totals	6,243	25,460	4,864	251,266	57,035	40,732	4,215	389,815
OUTLYING DISTRICTS—								
B.C. Packers' Association	17,084	2,171	2,642	7,601	35,100	17,793	98	82,489
Gosse-Millerd Packing Co., Ltd.	780	25	....	24,485	9,090	3,167	4	37,551
Kildala Packing Co., Ltd.	5,501	166	77	2,326	10,071	1,815	357	20,313
Wallace Fisheries, Ltd.	8,613	343	....	1,511	43,812	463	....	54,742
Draney Fisheries, Ltd.	6,424	19	10	13,708	23,930	8,373	71	52,535
Kimsquit Fisheries, Ltd.	4,204	68	18	2,271	12,872	1,637	368	21,438
Western Packers, Ltd.	7,907	95	....	2,699	10,503	2,304	....	23,508
Maritime Fisheries, Ltd.	....	2,508	182	9,024	31,033	368	78	43,193
Tallheo Fisheries, Ltd.	1,467	186	73	2,107	13,762	5,871	31	23,497
Western Salmon Packers, Ltd.	....	....	....	11,732	3,174	540	....	15,446
Lockport Canning Co.	....	....	....	13,000	8,500	....	....	21,500
Totals	51,980	5,581	3,002	90,464	201,847	42,331	1,007	396,212
Grand totals	276,459	65,535	41,819	497,615	527,745	191,068	15,916	1,616,157

STATEMENTS SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1903 TO 1918, INCLUSIVE.

FRASER RIVER.

	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.	1904.	1903.
Sockeyes	19,697	148,164	32,146	91,130	198,183	719,796	123,879	58,487	150,432	585,435	74,574	59,815	183,007	837,489	72,688	204,809
Springs, Red	15,192	10,197	17,673	23,228	11,209	3,573	15,856	7,028	1,018	1,428	1,903	3,448	7,523	5,507	9,482	2,084
Springs, White	24,853	18,916	11,430	5,392	15,300	49	9,826	6,751	8,925	.....	2,263	557	.....	.....	.....	.....
Chums	86,215	59,973	30,934	18,919	74,826	22,220	12,997	47,237	52,460	} 8,687	415	63,530	15,543	3,304	1,066	4,504
Pinks	18,388	134,442	840	138,305	6,272	20,773	574	142,101	128							
Cohoes	40,111	25,895	31,330	43,514	43,504	16,018	36,190	39,740	35,031	27,919	33,270	35,766	34,413	30,836	45,667	25,728
Steelhead Trout	4,395	4,951	3,129	31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	208,857	402,538	127,472	320,519	349,294	782,429	199,322	301,344	247,994	623,469	112,425	163,116	240,486	877,136	128,903	237,125

SKEENA RIVER.

Sockeyes	123,322	65,760	60,203	116,533	136,166	52,927	92,498	131,066	187,246	87,901	139,846	108,413	86,384	84,717	93,404	50,968
Springs	22,931	16,285	20,933	15,273	11,740	26,436	23,883	17,942	9,785	12,469	13,842	10,378	20,138	14,598	20,621	18,008
Chums	22,573	21,516	17,121	5,769	8,329	.....	504	70	.....	} 28,120	45,404	25,217	38,991	7,523	30,529	20,045
Pinks	161,727	148,319	73,029	107,578	71,021	66,045	97,588	81,956	13,473							
Cohoes	38,759	38,456	47,409	32,190	16,378	18,647	39,835	23,376	11,531	12,249	10,085	15,247	16,897	7,247	10,315	9,648
Steelhead Trout	4,994	1,883	3,743	1,798	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	374,306	292,219	223,158	279,161	237,634	164,055	254,258	254,410	222,035	140,739	209,177	159,255	162,420	114,085	154,869	98,669

RIVERS INLET.

Sockeyes	53,401	61,195	44,936	103,350	89,890	61,745	112,884	88,763	126,921	89,027	64,652	87,874	122,631	82,771	93,862	68,119
Springs	1,409	817	1,422	1,022	566	594	1,149	317	383	587	454	450	181	351	11	872
Chums	6,729	16,101	20,144	5,387	5,023	.....	3,845	288	.....	.....	.....	.....	.....	.....	.....	.....
Pinks	29,542	8,065	3,567	2,964	5,784	2,097	8,809	5,411	19	.....	479	700	.....	.....	61	180
Cohoes	12,074	9,124	15,314	7,115	7,789	3,660	11,010	6,287	2,075	1,400	9,505	5,040	66	.....	358	219
Totals	103,155	95,302	85,383	146,838	109,052	68,096	137,697	101,066	129,398	91,014	75,090	94,064	122,878	83,122	94,292	69,390

NASS RIVER.

Sockeyes	21,816	22,188	31,411	39,349	31,327	23,574	36,037	37,327	30,810	28,246	27,584	17,813	22,166	24,462	15,000	8,438
Springs	4,152	4,496	3,845	3,701	3,385	3,151	6,936	3,759	1,239	2,337	3,263	1,288	921	3,340	2,357	1,475
Chums	40,368	24,933	11,200	11,076	25,569	2,987	3,245	5,189	351	3,589	.....	.....	.....	.....	.....	.....
Pinks	59,206	44,568	59,593	34,879	25,333	20,539	12,476	11,467	895	.....	6,612	5,957	3,450	1,840	31	.....
Cohoes	17,061	22,180	19,139	15,171	9,276	3,172	12,468	7,942	6,285	6,818	8,348	6,093	5,997	3,083	1,697	2,187
Steelhead Trout	1,305	1,125	1,498	113	.....	.....	.....	.....	140	.....	1,101	681	.....	.....	.....	.....
Totals	143,908	119,495	126,686	104,289	94,890	53,423	71,162	65,684	39,720	40,990	46,908	31,832	32,534	32,725	19,085	12,000

VANCOUVER ISLAND DISTRICTS.*

	1918.	1917.
Sockeyes	6,143	9,639
Springs	29,324	19,509
Chums	251,266	240,381
Pinks	57,035	49,156
Cohoes	40,752	31,733
Totals	389,815	325,723

OUTLYING DISTRICTS.

	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.	1904.	1903.
Sockeyes	51,980	32,902	45,373	98,660	87,130	149,336	79,464	67,866	70,506	49,832	48,367	40,159	45,481	51,234	48,272	36,383
Springs	8,582	6,056	11,423	9,488	7,108	7,246	22,837	12,659	7,439	2,196	6,439	9,977	3,581	4,563	2,950	3,218
Chums	90,464	112,364	160,812	40,849	70,727	52,758	37,734	39,167	5,551	.....	.....	.....	.....	.....	.....	.....
Pinks	201,847	112,209	143,615	83,626	111,930	83,430	128,296	64,312	20,098	6,148	23,538	23,300	7,964	1,303	4,409	2,653
Cohoes	42,331	30,201	70,431	48,966	43,254	28,328	65,806	42,457	19,460	13,532	20,709	25,754	11,759	3,292	13,114	14,136
Steelhead Trout	1,009	865	712	985	.....	.....	.....	.....	.....	.....	36	2	.....	.....	.....	.....
Totals	404,793	294,597	432,366	313,894	320,168	285,898	334,187	226,461	123,054	71,708	99,089	99,192	68,785	60,392	68,745	56,390

TOTAL PACKED BY DISTRICTS IN 1903 TO 1918, INCLUSIVE.

	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.	1904.	1903.	Total for Districts.
Fraser	210,851	402,538	127,472	320,519	349,294	782,429	199,322	301,344	247,994	623,469	112,425	163,116	240,486	877,136	128,903	237,125	5,324,423
Skeena	374,216	292,219	223,158	279,161	237,634	164,055	254,258	254,410	222,035	140,739	209,177	159,255	162,420	114,085	154,869	98,669	3,340,360
Rivers Inlet	103,155	95,302	85,383	146,838	109,052	68,096	137,697	101,066	120,398	91,014	75,090	94,064	122,878	83,122	94,292	69,390	1,605,837
Nass River	143,908	119,495	126,686	104,289	94,890	53,423	71,162	65,684	39,720	40,990	46,908	31,832	32,534	32,725	19,085	12,000	1,035,331
*Vancouver Island	389,815	325,723	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	715,538
Outlying Districts	404,793	294,597	432,366	313,894	320,169	285,898	334,187	226,461	123,054	71,708	99,089	99,192	68,785	60,392	68,745	56,390	3,259,720
Grand totals	1,626,738	1,557,485	995,065	1,164,701	1,111,039	1,353,901	996,626	948,965	762,201	967,920	542,689	547,459	627,103	1,167,460	465,894	473,574	15,281,209

STATEMENT SHOWING SALMON-PACK OF PUGET SOUND, BY SPECIES, FROM 1904 TO 1918.

	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.	1904.
Sockeyes	50,723	411,538	84,637	87,465	357,374	1,665,728	201,572	140,529	234,437	1,005,120	162,228	96,974	182,241	837,122	123,419
Cohoes	235,860	114,276	155,832	180,799	151,135	49,150	149,977	244,208	154,077	139,297	95,863	111,611	98,206	89,636	106,856
Puget Sound Pinks	6,605	1,121,884	1,887	589,780	909	788,789	708	1,038,136	.....	365,156	.....	448,730	.....	71,490	.....
Chums	267,538	216,285	427,878	410,687	280,070	50,176	63,132	111,143	148,810	52,251	51,186	51,840	155,221	49,047	56,355
Totals	560,726	1,863,983	670,234	1,268,731	789,488	2,553,843	415,389	1,534,016	537,324	1,561,824	309,277	709,155	435,668	1,047,295	286,630

*Previously the Vancouver Island pack was shown in Outlying Districts pack.

EIGHTH ANNUAL REPORT

OF THE

SUPERINTENDENT OF INSURANCE

FOR THE

PROVINCE OF BRITISH COLUMBIA

1919

(BUSINESS TRANSACTED IN 1918)

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1919.

To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The undersigned has the honour to present the Eighth Annual Report of the Superintendent of Insurance for the year ended December 31st, 1918.

J. W. DE B. FARRIS,

Attorney-General.

Victoria, B.C., July 10th, 1919.

REPORT OF THE SUPERINTENDENT OF INSURANCE.

DEPARTMENT OF INSURANCE,
VICTORIA, B.C., July 10th, 1919.

The Honourable J. W. de B. Farris,
Attorney-General, Victoria, B.C.

SIR,—Pursuant to the "British Columbia Fire Insurance Act" and the "Insurance Act," I have the honour to submit herewith a report for the year ended December 31st, 1918, being the Eighth Annual Report of the Department, but the first to the Attorney-General as Minister under the Act.

I. "BRITISH COLUMBIA FIRE INSURANCE ACT."

(1.) FIRE INSURANCE COMPANIES.

At the close of 1918, 109 companies were licensed to carry on the business of fire insurance, the number being the same as in the previous year. Four are limited to insurance of automobiles against fire, as appears by the full list on pages 25, 26. The origin of the different companies is shown in the following table:—

Where incorporated.	Dominion Licensees.	Provincial Licensees.	Total.
Dominion of Canada	21	..	21
Provinces of Canada	5	..	5
Great Britain	32	..	32
Australia	1	..	1
Hong Kong	2	..	2
United States	43	1	44
France	4	..	4
Totals	108	1	109

Seven companies obtained licences during 1918, namely:—

American Alliance Insurance Company.
British Traders' Insurance Company.
Car & General Insurance Corporation, Limited.
The Fire Insurance Company of Canada.
New Hampshire Fire Insurance Company.
The North American Accident Insurance Company.
Queensland Insurance Company, Limited.

The American Alliance Insurance Company, formerly known as "German Alliance Insurance Company," has held a licence for some years, but had withdrawn from the Province. The North American Accident Insurance Company is limited to insurance of automobiles against fire.

The companies holding a Provincial licence which in 1918 obtained Dominion licences were as follows:—

Boston Insurance Company.
Fire Association of Philadelphia.
Mechanics & Traders Insurance Company.
National Benefit Assurance Company, Limited.
Newark Fire Insurance Company.
New Jersey Fire Insurance Company.
Northwestern Mutual Fire Association.
Union Marine Insurance Company, Limited.
Vulcan Fire Insurance Company of Oakland, Cal.

Six companies withdrew, all except the last named hailing from the United States. In every case the step was taken because their arrangements and circumstances did not warrant their complying with the requirements of the Federal "Insurance Act, 1917." It will be remembered that eight companies retired from the Province in the previous year for the same reason. Injury to the interests of the Province must have occurred through the removal of the competition of these fourteen companies. The companies ceasing business in 1918 were:—

Detroit Fire and Marine Insurance Company.
Industrial Fire Insurance Company.
Michigan Fire and Marine Insurance Company.
Minneapolis Fire and Marine Insurance Company.
Reliance Insurance Company of Philadelphia.
Svea Fire & Life Insurance Company.

As compared with 1917, the premiums showed an increase of more than $400,000, but, on the other hand, the losses paid were larger. It may be surmised that the changes in the figures were alike due to war hazards and the rise in values. The statistics will be found in Table I., pages 29, 30. A statement has been added to the table to indicate in some measure what other sums are disbursed out of the premiums collected, over and above the amounts paid for losses. The bald figures of premiums and losses are apt to convey the misleading impression that the balance is mainly profit. On the other hand, Table IV. demonstrates that the underwriting profit in this Province must be considerable, and in some measure justifies the claim for a reduction of the rates in force. It will be observed that, if we omit Prince Edward Island and the Yukon, British Columbia has the best record in Canada for the last three years.

(2.) FIRES.

The subject of fire-waste and fire-prevention has received a great deal of publicity, and it is quite clear that there exists considerable apprehension and alarm over the situation. The huge losses sustained by the country year after year are, it is recognized, a peril and contribute to the upward tendency of prices. In Ontario a league was formed, and is in active operation, for the purpose of fighting the negligence and carelessness, which lies at the root of the whole problem. While the organization is affiliated with the Fire Marshal's Department, it is founded on voluntary effort in the public interest. In this Province a similar league was established independently and simultaneously (indicating the degree to which public opinion is awakened) under the title of the "British Columbia Fire-prevention League." At the close of 1918 the league had not actually commenced work, because the appointment of its first executive was not complete, and it was felt to be of paramount importance that the officers should be men to whom the public would listen and who would devote real energy to the cause. At Ottawa the Dominion's Superintendent of Insurance called together a very similar body, and has established in his Department a special branch for fire-prevention work. There is no doubt in my mind that, even though these efforts do not bear fruit in the manner visualized by their promoters, results will come, and we can confidently anticipate that the community will before long be stirred to realize the vital necessity of diminishing the fire loss.

The work of the Department in the field of fire inquiry and inspection has been vigorously carried on by Mr. J. A. Thomas, who was appointed under the amendments of 1918 to the "British Columbia Fire Insurance Act." I cannot speak too highly of his efforts and enthusiasm, and am convinced that his services have already proved of the greatest benefit. It is obvious, however, that one man cannot cope with the work, and I submit for serious consideration the enlargement of the staff for this purpose. Ways and means are, of course, the serious factor in the present state of finances; but I may point out that in several Provinces a special tax of ⅓ of 1 per cent. of the premium income is levied on the fire insurance companies. The fund so formed is ear-marked as if it were a trust fund, for the sole purpose of fire prevention and investigation. The officials then appointed constitute an expert corps which not only carries out the instructions of the Department, but acts as auxiliary and advisory to the municipal and other officials who already exist.

The fire statistics (pages 31-39) are not so satisfactory as during the past few years. There is a considerable increase in the number of fires and the amount of loss. The latter figures for the first time exceed $2,000,000, making an average loss *per diem* of over $5,000 and a *per capita* loss of $5.25, with 400,000 as a round estimate of population for the Province. It

should be observed that the losses shown in Table I. comprise only losses covered by insurance. The difference between the two sets of figures, less the amount covered by unlicensed insurance, is absolute loss.

The larger figures for 1918 I ascribe in part to a more complete series of reports and to the enhanced values of property destroyed. With regard to reports, I may remark that the persons and companies responsible are filing them more promptly and in better shape than in the past. It is hoped that the importance of keeping these comprehensive statistics will be fully realized in order that effective steps may be devised for a reduction of the fire waste. In particular I should like to see a still further reduction in the number of fires of "unknown" origin. Experience gained by investigation will no doubt tend to produce that result. It is hoped, moreover, that the campaign for thrift and conservation will bear fruit and the figures for 1919 show a distinct improvement. No one who examines the statistics can fail to be struck by the numerous instances where carelessness only was the reason for the fire. Many of these fires are no doubt insignificant in themselves, but reviewed in the aggregate and with a realization of the danger attaching to every fire they are extremely serious.

Analysing the figures and comparing them with 1917, we find that the losses in the district municipalities are mainly responsible for the increased loss. Burnaby, Delta, Maple Ridge, Point Grey, and Richmond show considerably higher figures; the last named due to the conflagration at Steveston. Among the cities Vancouver's fires and losses alike record increases, accounting for 75 per cent. of the total losses in city municipalities. Its *per capita* loss is higher than the average for the Province. The showing of Victoria is highly creditable. In the table setting forth the causes of fires the increase in number of fires due to exposure is largely attributable to the Steveston fire. Sparks from different sources caused 25 per cent. of the total number of fires. There were four lives lost by fire during the year.

Fires involving a loss of more than $30,000 numbered eleven, and their importance may be estimated by the fact that their total loss amounted to $1,296,000, or over 61 per cent. of the year's loss. The balance of 39 per cent. was caused by 933 fires. These figures are striking, but tell the same story as any similar statistics for Canada and the United States. The eleven fires occurred as follows: Six on lumber-mill premises, one each in a shipyard, a factory, a warehouse, and a store, and one at Steveston. The practical importance of proper inspection is well illustrated by the Steveston fire, which was due to a defective stove-pipe. But the moral of these figures as a whole is that primary and continuous attention should be directed by all parties to the necessity of keeping plants of all descriptions free from fire hazards.

Five formal fire investigations were held under the "British Columbia Fire Insurance Act" as amended in 1918, and although no case of arson came to light, there is no doubt that the inquiries were beneficial. Apart from these, Mr. Thomas has conducted numerous investigations with the aim of preventing fires, and in that field has achieved fine results.

II. "INSURANCE ACT."

At the end of last year 107 companies held licences under this Act for the various forms of insurance other than fire. The list is printed on page 27 and followed by some statistics of their business. I append a summary of these companies:—

Where incorporated.	Dominion Licensees.	Provincial Licensees.	Total.
British Columbia	..	2	2
Canada	34	..	34
Other Provinces of Canada	3	2	5
Great Britain	20	10	30
Australia	1	1	1
Hong Kong	2	2	4
Japan	..	1	1
United States of America	29	1	30
Totals	88	19	107

During 1918 sixteen new companies were granted licences here, namely:—

British America Assurance Company.
British Traders' Insurance Company, Limited.
Car & General Insurance Company, Limited.
Continental Casualty Company.
Equitable Fire and Marine Insurance Company.
Great American Insurance Company.
Great North Insurance Company.
Maryland Assurance Corporation.
North American Accident Insurance Company.
Northwestern National Insurance Company.
Phoenix Insurance Company.
Standard Marine Insurance Company.
Tokio Marine & Fire Insurance Company.
Western Empire Life Assurance Company.
Western Life Assurance Company.
The World Marine & General Insurance Company, Limited.

All hold Dominion licences, except the Western Empire Life Assurance Company, which transacts life insurance, and the Standard Marine Insurance Company, Tokio Marine Insurance Company, and the World Marine Insurance Company, Limited, which transact only marine insurance, for which no licence is issued at Ottawa.

Two companies withdrew, the North American Accident Insurance Company and the Western Life Assurance Company, both having been absorbed by the companies of similar named mentioned above; Federal Acts of incorporation replacing Provincial Acts.

Five companies were issued supplementary licences, as follows:—

Employers Liability Assurance Corporation, Limited (automobile, burglary, steam-boiler, and plate-glass insurance).
General Accident Assurance Company of Canada (guarantee insurance).
Great American Insurance Company (marine insurance).
Guardian Insurance Company of Canada (automobile insurance).
Home Insurance Company (explosion insurance).

The business done in the field of life insurance again shows a large increase, and well over $100,000,000 of life insurance is now in force in the Province. Life insurance is one index to the conditions of trade, and high wages with continuous employment are generally reflected in more new policies, fewer lapsed policies, and a smaller number of loans secured by policies. The campaign for thrift, however, should help the agents not only to secure new business, but to persuade policyholders to keep up their insurance, even though work and money should be less plentiful than during the war period. No separate figures are available to show whether the companies were called on for heavy payments owing to the epidemic of influenza, but it may be inferred from the amount of policies which became claims during 1918 and of the unsettled claims that the ravages of the disease here were responsible for a large proportion. The statistics are given on pages 41, 42, the summary on page 42 for a five-year period being a new table.

The total premiums received in 1918 for the miscellaneous forms of insurance show an increase of more than $200,000 over the previous year. The figures for health and accident insurance, automobile insurance, and marine insurance indicate a larger volume of business, while employers' liability declined. The number of companies ready to write the various forms of automobile policies has grown from thirty-two to thirty-nine. As the use of the automobile spreads the owner realizes how essential it is for him to be protected against the risks incident. The expansion of the ship-building industry accounts for the larger amount of marine insurance. The development in health and accident insurance is a good sign and likely to continue. The epidemic of influenza has brought home to the public the value of insurance against sickness, while the number of motor accidents emphasizes the need of protection in the case of accident. The usual table for miscellaneous insurance appears on pages 42-44, and a new table covering a period of five years on page 42.

III. GENERAL.

In October, 1918, a conference took place at Regina of the Superintendents of Insurance for Ontario, Manitoba, Saskatchewan, and Alberta. I was invited to attend, but did not feel that the subjects for discussion justified the length of absence necessary. The principal matter was a model set of statutory conditions for health and accident policies, a draft of which had been in my hands for suggestion and criticism. The meeting was pleased to accept a number of suggestions made by me and practically settled a draft. It remains for the draft to be submitted to the various Provincial Governments. The conference was noteworthy for the fact that it was the first at which the representative for Ontario was present.

The Legislature at its session this year carried into practice the principle of uniform legislation by enacting a new "Fire-insurance Policy Act." The statutory conditions contained in the Act are practically identical with those in force in Alberta, Saskatchewan, Manitoba, and Ontario. The other amendments to the Statutes relating to insurance do not call for special mention.

Allusion should be made to the resolution of the Legislature that "early consideration by the Government of legislation with respect to State Health Insurance . . . is desirable." It is a matter fraught with great potentialities for both success and failure. State insurance of this kind has, of course, been in existence for many years in Germany and for some few years in England, but in America it is a novelty. There has been recently much debate and close investigation by our neighbours across the line, and in some States the question has been put to the vote of the people; for example, in California, where it was rejected. The arguments pro and con are naturally very numerous and the considerations involved of grave importance. It may be asserted that the experience of England and Germany is of little value in determining whether such proposals are practicable in this Province. The conditions of the population and the area affected, both leading factors, are so different. There is a large body of opinion in the United States adverse to such State insurance, and the most notable element of the opposition is the American Federation of Labour, which is absolutely hostile. The public here seems to be little acquainted with the subject and its ramifications, and the hope may be expressed that the press will thoroughly investigate it before urging either its adoption or rejection.

The losses by fire having during recent years grown to such perilous dimensions, legislation respecting prevention of fire was enacted in April last by Parliament. Provisions have been embodied in the Criminal Code, making negligence under certain circumstances a crime. The amendments are so important that I feel they should receive as much publicity as possible, and have therefore set them out at length on page 46 of this report.

Last year I ventured to suggest in my report that the Insurance Acts referred to in the foregoing pages should be consolidated, and the experience of another year has confirmed the view I then entertained.

There is, too, an increasing number of insurance agents in favour of legislation which would make a licence a necessary qualification before any one could act as such agent. Other Provinces and many States have a law of this kind, and I believe I am correct in saying that everywhere it has proved of high value, not only to the public, but also to the insurance fraternity. The subject deserves early consideration.

I have the honour to be,
Sir,
Your obedient servant,
H. G. GARRETT,
Superintendent of Insurance.

APPENDIX.

INSURANCE OTHER THAN FIRE INSURANCE.

Annual Statement of Provincial Licensees for the Year ended December, 31st, 1918.

BRITISH COLUMBIA PLATE GLASS INSURANCE COMPANY.

Head Office—Vancouver, B.C.

Directors.

Walter E. Graveley, President. — A. G. Thynne.
A. F. Beasley. — H. W. Chamberlin.
F. M. Chaldecott.

Alfred Farmer, Secretary-Treasurer.

Amount deposited with the Government of British Columbia: British Columbia Inscribed Stock, £200; Township of Richmond bonds, $5,000; Dominion of Canada War Loan bonds, $1,000; total (par), $6,972.66.

Authorized capital	$25,000 00
Amount subscribed	9,600 00
Amount paid up	3,840 00

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

Cash value (excluding interest and dividends) of stock, shares, bonds, debentures, etc.	$14,130 68
Cash on deposit to the Company's credit and not drawn against on December 31st, 1918	1,174 84
Premiums uncollected (net commissions deducted)	2,474 48
Solicitors' balances not included above	35 00
Total assets	$17,815 00

Liabilities.

Total reserve of unearned premiums, $15,956.64; carried out at 80 per cent. thereof..	$12,765 30
Total amount of liabilities	$12,765 30
Capital stock paid up	3,840 00
Total of liabilities and paid-up capital	$16,605 30
Excess of assets over such total	$ 1,209 70

Receipts.

Net cash received for premiums	$12,306 44
Cash received for interest	776 27
Cash from all other sources	388 47
Total receipts	$13,471 18

Expenditure.

Cash paid to agents for commission, salaries, and bonus	$ 4,328 83
„ for statutory assessment and licence fees	292 38
„ „ salaries, directors' and auditors' fees	349 50
„ „ postage	10 00
„ „ other expenses	24 50
Total expenses of management	$ 5,005 21
Amount paid for losses occurring during the year	7,382 81
Cash paid for debentures, mortgages, etc. (not extended), $3,642.50.	
Total expenditure	$12,388 02

LIST OF SHAREHOLDERS.

Name.	Residence.	No. of Shares.	Amount subscribed.	Amount paid.
H. Bell-Irving	Vancouver..	5	$ 500	$ 200
W. G. Graveley	„	5	500	200
A. McCreery	„	1	100	40
A. F. Beasley	Victoria ...	7	700	280
T. O. Richards	Vancouver..	1	100	40
H. W. Chamberlin	„	5	500	200
H. C. Ackroyd	„	1	100	40
D. B. Charleson	„	1	100	40
W. J. Albutt	„	17	1,700	680
R. Martin	„	1	100	40
J. Rogers	„	2	200	80
A. G. Thynne	„	35	3,500	1,400
F. M. Chaldecott	„	5	500	200
C. E. Hope	„	2	200	80
T. A. Blythe (Estate of)	„	3	300	120
P. W. Charleson	„	5	500	200
		96	$9,600	$3,840

CANTON INSURANCE OFFICE, LIMITED.

Head Office—Victoria, Hong Kong.

Consulting Committee.

The Hon. Dr. David Landale, Chairman.
The Hon. Sir Paul Chater, C.M.G.
C. S. Gubbay.
A. H. Compton.
Sir Robert Ho Tung.
F. Maitland.
T. E. Pearce.
H. P. White.

General Agents.

Messrs. Jardine, Matheson & Co., Limited, Hong Kong.

Capital authorized and subscribed	$2,500,000 00
Amount paid up	500,000 00

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

Cash in hand, in transit, and on current account and fixed deposits with banks	$1,173,310 84
Gold investments—	
British, Indian, and Colonial Government bonds and stocks	3,617,097 35
Foreign Government loans	416,645 96
British, Colonial, and Foreign railway and port trust bonds and stocks	252,087 21
Silver investments—	
Hong Kong Government 6% War Loan of 1916	100,000 00
Mortgages, loans, and debentures	1,491,879 75
Other investments	444,099 49
Agency balances	518,965 42
Accounts receivable	143,280 74
Total assets	$8,157,366 76

Liabilities.

Capital, 10,000 shares of $250 each = $2,500,000, of which $50 per share has been paid up		$ 500,000 00
Reserve Fund		1,192,546 58
Reinsurance Fund		1,179,804 81
Investment and Exchange Fluctuation Account		377,619 41
Underwriting Suspense Account		304,531 25
Uncollected dividends		30,457 00
Accounts payable		122,071 65
Working Account, 1917	$1,479,155 28	
Less interim dividend at $18 per share paid on May 17th, 1918	180,000 00	
		1,299,155 28
Working Account, 1918		3,151,180 78
Total liabilities		$8,157,366 76

NOTE.—Dollars in Hong Kong currency, with sterling exchange standing at 3s. 4¼d.

THE GREAT NORTH INSURANCE COMPANY.

Head Office—Calgary, Alberta.

Directors.

W. J. Walker, President.
Hon. A. C. Rutherford.
Hon. P. E. Lessard.
Lieut. F. A. Walker.
Edward J. Fream.
Geo. H. Ross.
J. K. McInnis.

J. T. North, Secretary.

Amount deposited with the Government of British Columbia: $5,000 in cash.

Authorized capital	$500,000 00
Amount subscribed	221,700 00
Amount paid up in cash	46,731 24

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

Cash value of mortgages, exclusive of interest	$ 7,300 00
Cash value (excluding interest and dividends) of stock, shares, bonds, debentures, etc.	40,672 37
Cash on hand at Head Office	2,985 78
Cash on deposit to the Company's credit and not drawn against on December 31st, 1918	55,774 35
Agents' balances and premiums uncollected	15,467 33
Bills receivable one year or more overdue (not extended), $17,071.76.	
Premium notes in course of collection	6,656 62
Amount of all other assets	7,479 65
Office furniture, etc. (not extended), $5,000.	
Total assets	$136,333 10

Liabilities.

Claims or losses adjusted	$ 883 85
Claims or losses resisted	1,000 00
Claims or losses in suspense, or supposed, or reported	5,950 00
Total amount of losses or claims unpaid	$ 7,833 85
Live-stock reserve, 50 per cent. of premiums in force	13,378 48
Total reserve of unearned premiums for all outstanding risks	23,767 03
Dividends declared and remaining unpaid	4,636 56
Amount of all other liabilities	11,031 11
Total amount of liabilities	$ 63,647 03
Capital stock paid up in cash	46,731 24
Total of liabilities and paid-up capital	$110,378 30
Excess of assets over such total	$ 25,957 80

Receipts.

Net cash received for premiums	$231,280 91
Cash received for interest	3,830 51
Cash received for calls on capital stock	7,931 78
Total receipts	$243,043 20

Expenditure.

Cash paid to agents for commission, salaries, and bonus	$ 58,252 96
„ for law costs	1,609 11
„ „ fuel and light	27 22
„ „ investigation and adjustment of claims	2,370 14
„ „ interest, discount, and exchange	335 73
„ „ statutory assessment and licence fees	9,054 88
„ „ travelling expenses	7,123 21
„ „ rent and taxes	971 48
„ „ salaries, directors' and auditors' fees	28,340 47
„ „ printing, stationery, and advertising	4,707 11
„ „ postage, telegrams, and express	1,032 59
„ „ other expenses	14,542 69
Total expenses of management	$128,367 59
Net amount paid for losses occurring prior to 1918	1,222 88
Net amount paid for losses occurring during 1918	82,885 92
Cash paid for dividends	5,643 75
Cash paid for other expenditure	1,131 22
Total expenditure	$219,251 36

RETURNS FOR BRITISH COLUMBIA.

Deposit with Government, cash	$5,000 00
Other assets	250 00
Liabilities	16 00
Premiums written, less return premiums	32 00
Losses incurred, net	.....
Losses paid, net	.....
Net amount at risk	400 00

LONDON & PROVINCIAL MARINE & GENERAL INSURANCE COMPANY, LIMITED

Head Office—London, England.

Directors.

Edwin Gray, Chairman.
James W. Arbuthnot.
James Hamilton.
Richard de Neufville.
Herbert E. Secretan.
William M. Strachan.

Irving G. Cortazzi, Secretary.

Capital authorized and subscribed	£1,000,000
Amount paid up	100,000

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

	£	s.	d.
By Investments (valued as at December 31st, 1913; investments made since that date are valued at cost)	1,295,442	4	7
Interest accrued	10,518	18	1
Cash on deposit and at bankers	62,407	8	11
Outstanding accounts due at home and abroad	84,497	5	8
Policy stamps	187	7	5
Total assets	£1,453,053	4	8

Liabilities.

	£	s.	d.
To Authorized capital, 100,000 shares of £10 each = £1,000,000.			
Paid-up capital, 100,000 shares of £10, £1 paid	100,000	0	0
Reserve Fund	200,000	0	0
Sundry creditors	68,560	10	3
Investment reserve	100,000	0	0
Underwriting Suspense Account to meet all claims and other liabilities on 1917 and previous years	279,500	6	3
Balance of Underwriting Account, 1918	519,727	5	3
Balance of Profit and Loss Account	185,265	2	11
Total liabilities	£1,453,053	4	8

MARITIME INSURANCE COMPANY, LIMITED.

Head Office—Liverpool, England.

Directors.

E. H. Cookson, Chairman. J. A. Cook.
J. F. Caroe. J. M. Wood.
Wm. C. Aikman.

John Crosby Nicholson, Secretary.

Authorized capital	£1,000,000
Amount subscribed	500,000
Amount paid up	100,000

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

	£	s.	d.
By Investments	1,375,356	18	9
Sundry debtors	148,867	11	7
Interest and dividends accrued, but not payable until after December 31st, 1918	5,794	3	11
Cash on deposit, in hand, and on current account	63,275	18	1
Total assets	£1,593,294	12	4

Liabilities.

	£	s.	d.
To Shareholders' capital paid up	100,000	0	0
General Reserve Fund	200,000	0	0
Underwriting Fund	922,494	17	0
Profit and Loss Account	143,617	8	9
	£1,366,112	5	9
Sundry creditors	227,182	6	7
Total liabilities	£1,593,294	12	4

NATIONAL PLATE GLASS INSURANCE COMPANY.

Head Office—Winnipeg, Man.

Amount deposited with the Government of British Columbia: City of Salmon Arm bonds, $5,000; City of Nelson bonds, $300; City of Alberni bonds, $210; total (par), $5,510.

Authorized capital	$30,000 00
Amount subscribed	15,000 00
Amount paid up	5,430 00

No business transacted in British Columbia during 1918.

THE OCEAN MARINE INSURANCE COMPANY, LIMITED.

Head Office—London, England.

Directors.

Hon. Charles Napier Lawrence, Chairman.
Sir Alex. Drake Kleinwort.
Herbert Robinson Arbuthnot.
Harry Cunningham Brodie.
James Blyth Currie.
Phillipp Moritz Deneke.
Maurice Ruffer.
Philip Secretan.
David Nairn Shaw.

H. T. Russell Ross, Secretary.

Capital authorized and subscribed	£1,000,000
Amount paid up	100,000

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.	£	s.	d.
British Government securities	393,185	15	0
Public boards, United Kingdom	32,331	5	0
Municipal and county securities, United Kingdom	33,767	10	0
Indian and Colonial Government securities	69,795	12	6
Foreign Government securities	191,216	7	0
Colonial municipal securities	21,468	15	0
Foreign municipal securities	66,460	13	11
Guaranteed and other Indian railway stock	32,180	0	0
Indian Government railway annuities	9,975	0	0
Railway and other debentures and debenture stocks, home and foreign	141,835	6	5
Railway preference and guaranteed stocks	9,000	12	8
Railway ordinary stocks	21,835	16	0
Loans on stocks and shares	233,437	10	0
	£1,256,490	3	6
Freehold premises	126,000	0	0
	£1,382,490	3	6

	£	s.	d.
Agents' balances	121,618	14	7
Outstanding premiums, etc.	76,891	7	0
Bills receivable	99	0	0
Interest accrued but not yet payable	12,176	0	0
Policy stamps on hand	226	13	9
Cash—			
On deposit	92,146	10	7
In hand and on current account	14,543	6	6
Total assets	£1,700,191	15	11

Liabilities.

	£	s.	d.
Capital, 40,000 shares of £25, paid up £2 10s. per share (now vested in the North British and Mercantile Insurance Company)	100,000	0	0
Marine Fund—			
Reserve £500,000 0 0			
Profit and loss 237,551 7 9			
	737,551	7	9
Underwriting Reserve	102,685	1	1
Balance of Underwriting Account, 1918	413,526	9	6
Sundry creditors	346,428	17	7
Total liabilities	£1,700,191	15	11

QUEENSLAND INSURANCE COMPANY, LIMITED.

Head Office—Sydney, Australia.

Directors.

Col. the Hon. Sir James Burns, K.C.M.G., M.L.C., Chairman.

P. G. Black. Hon. Thomas Waddell, M.L.C.
A. R. Troup. W. T. MacPherson.

H. W. Horn, Secretary.

Authorized capital	£500,000
Amount subscribed	350,000
Amount paid up	350,000

Statement for the Year ended September 30th, 1918.

Assets.

				£	s.	d.
By Government securities	£312,013	19	10			
Fixed deposits with various banks	174,500	0	0			
Municipal debentures	45,565	0	0			
Freehold properties	110,918	2	3			
Cash deposits at call	98,500	0	0			
Cash in hand and at bankers	22,224	1	5			
				763,721	3	6
Sundry debtors				9,025	12	2
Premiums outstanding				23,039	7	5
Reinsurance claims, return premiums, and refunds outstanding				7,376	2	0
				£803,162	5	1

Liabilities.

	£	s.	d.
To Authorized capital, 500,000 shares of £1 each = £500,000. Subscribed capital, 350,000 shares of £1 each	350,000	0	0
Reserve Fund	75,000	0	0
Unearned premiums	117,585	17	1
Officers' Provident Fund	17,600	9	8
Sundry creditors, reinsurances, claims, and provision for taxation	152,048	14	10
Branch and agency balances	44,064	17	9
Revenue Account	46,862	5	9
	£803,162	5	1

THE RELIANCE MARINE INSURANCE COMPANY, LIMITED.

Head Office—Liverpool, England.

Directors.

Gilbert W. Fox, Chairman. J. U. Hodgson.
George Atherton. Oswald Dobell.
Lieut.-Col. F. R. S. Balfour. The Hon. Evelyn Hubbard.
R. A. Love. R. S. Sharples.

F. R. Edwards, Secretary.

Authorized capital	£500,000
Amount subscribed	500,000
Amount paid up	100,000

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

				£	s.	d.
By	Investments at market value	£503,590	5 8			
	Less loans on war stock	27,500	0 0			
				476,090	5	8
	Policy stamps			212	14	1
	Cash at bankers and in hand			24,194	8	11
	Interest accrued but not received			3,758	12	1
	Accounts due to the Company for premiums, salvages, etc.			132,037	14	4
				£636,293	15	1

Liabilities.

				£	s.	d.
To	Capital, 50,000 shares at £10 per share, £500,000; paid up £2 per share			100,000	0	0
	Reserve Fund			150,000	0	0
	Balance of Profit and Loss Account	£82,896	18 0			
	Less interim dividend paid July 1st, 1918	7,500	0 0			
				75,396	18	0
	Balance of Marine Account, 1918			140,468	18	6
	Fire Insurance Fund			48,919	13	0
	Suspense and Special Reinsurance Accounts			54,316	19	10
	Accounts due by the Company			67,168	14	0
	Dividends unpaid			22	11	9
				£636,293	15	1

ROYAL PLATE GLASS INSURANCE COMPANY OF CANADA.

Head Office—Vancouver, B.C.

Directors.

Dr. D. H. Wilson, President. R. W. Harris.
J. P. Nicolls. A. P. Bogardus.
W. H. Malkin.

C. A. Wickens, Secretary-Treasurer.

Amount deposited with the Government of British Columbia: Deposit receipt of Canadian Bank of Commerce, $125; Dominion War Loan bonds (par), $5,000; total, $5,125.

Authorized capital	$25,000
Amount subscribed	10,000
Amount paid up	2,750

Statement for the Year ended December 31st, 1918.

Assets.

Cash value of real estate, less encumbrances	$ 2,250 00
Cash value (excluding interest and dividends) of stock, shares, bonds, debentures, etc.	7,000 00
Cash deposited with Government	125 00
Cash on deposit to the Company's credit and not drawn against on December 31st, 1918	198 76
Agents' balances and premiums uncollected	202 37
Interest due or accrued and unpaid	64 83
Commissions paid in advance	732 66
Total assets	$10,573 62

Liabilities.

Reserve of unearned premiums, $2,169.08; carried out at 80 per cent. thereof	$ 2,711 36
Amount of all other liabilities	673 18
Total amount of liabilities	$ 3,384 54
Capital stock paid up	2,750 00
Total amount of liabilities and paid-up capital	$ 6,134 54
Excess of assets over such total	$ 4,439 08

Receipts.

Net cash received for premiums	$ 2,817 43
Cash received for interest	614 90
Total receipts	$ 3,432 33

Expenditure.

Cash paid to agents for commission, salaries, and bonus	$ 817 82
„ for interest, discount, and exchange	48 17
„ „ statutory assessment and licence fees	64 57
„ „ rent and taxes	23 48
„ „ other expenses	18 10
Total expenses of management	$ 972 14
Amount paid for losses occurring prior to 1918	313 36
Amount paid for losses occurring during 1918	1,136 90
Cash paid for debentures, mortgages, etc. (not extended), $1,460.73.	
Cash paid for other expenditure	32 40
Total expenditure	$ 2,454 80

LIST OF SHAREHOLDERS.

Name.	Residence.	No. of Shares.	Amount Subscribed.	Amount paid.
A. P. Bogardus	Vancouver	10	$1,000	$ 275 00
D. H. Wilson	"	14	1,400	385 00
R. W. Harris	"	14	1,400	385 00
W. H. Malkin	"	14	1,400	385 00
C. A. Wickens	"	8	800	220 00
P. G. Mason	"	8	800	220 00
J. P. Nicolls	"	5	500	137 50
I. Douglas	Boston, U.S.A.	12	1,200	330 00
M. Douglas	" "	5	500	137 50
R. D. Douglas	Binghampton, U.S.A.	5	500	137 50
N. S. Douglas	" "	5	500	137 50
		100	$10,000	$2,750 00

STANDARD MARINE INSURANCE COMPANY, LIMITED.

Head Office—Liverpool, England.

Directors.

F. W. Pascoe Rutter, Chairman. Walter B. Duckworth.
Jas. W. Alsop. James G. Nicholson.
John H. Clayton.

N. B. Barnes, Secretary.

Capital authorized and subscribed £500,000
Amount paid up 100,000

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

	£	s.	d.
Investments and loans	870,795	5	3
Cash at bankers and in hand	113,029	10	10
Bills receivable	2,067	17	8
Sundry debtors	248,054	18	3
Accrued interest	10,250	0	4
Stamps in hand	366	17	4
Total assets	£1,244,564	9	8

Liabilities.

	£	s.	d.
Capital, 25,000 shares of £20 each, £4 per share paid	100,000	0	0
Reserve Fund	500,000	0	0
Reserve for unexpired risks	126,578	0	0
Provision for income-tax, 1918, and excess-profits duty, 1917 and 1918	127,566	15	0
Balance, Profit and Loss Account	58,734	11	3
Dividend for the year 1918	35,000	0	0
Bills payable	3,350	4	4
Claims outstanding	153,389	0	0
Sundry creditors	139,945	19	1
Total liabilities	£1,244,564	9	8

THE TOKIO MARINE & FIRE INSURANCE COMPANY, LIMITED.

Head Office—Tokio, Japan.

Directors.

M. Suyenobu, Chairman.	K. Mimura.
T. Abe.	S. Sasaki.
S. Komuro.	H. Shoda.
Baron R. Kondo.	Baron K. Sonoda.

Capital authorized and subscribed ..... Y. 15,000,000
Amount paid up 7,500,000

Statement for the Year ended December 31st, 1918.

Assets.

	Yen	sen.
Capital unpaid	7,500,000	00
Office premises, etc.	1,660,000	00
Japanese Government securities	3,537,616	28
British Government securities	4,376,076	92
United States Government securities	1,245,588	23
Anglo-French 5% External Loan Bonds	88,235	29
Japanese and foreign municipal bonds	1,134,445	02
United States railroad and other bonds and shares	1,531,960	82
Bonds and debentures of various companies	3,243,123	08
Shares in various companies	8,317,075	00
Loans on mortgage, etc.	11,341,223	13
Accounts due to the Company	11,113,225	98
Amount due by Government under "War Risk Indemnity Act"	5,284	72
Amount due by Government under "War Risk Reinsurance Act"	733,813	85
Cash at bankers, on deposit and current accounts, and in hand	25,526,977	91
	81,354,646	23

Liabilities.

		Yen	sen.
Share capital		15,000,000	00
Legal Reserve Fund		2,500,000	00
Underwriting Fund—			
Underwriting Reserve	Y. 35,250,000.00		
„ Suspense	9,510,363.51		
		44,760,363	51
Staff Pension Fund		381,446	15
Accounts due by the Company		13,273,176	24
Premium due Government under "War Risk Reinsurance Act"		410,179	97
Profit and Loss Account		5,029,480	37
		81,354,646	23

THE WESTERN EMPIRE LIFE ASSURANCE COMPANY.

Head Office—Winnipeg, Man.

Directors.

Wm. Smith, President. S. D. Hannah.
R. W. Craig, K.C. G. N. Broatch.
A. J. Fraser, M.D. G. E. Graham.
W. P. Rundle. F. D. Byers.

F. C. O'Brien, Secretary.

Amount deposited with the Government of British Columbia: 27 Dominion Victory Loan bonds (par), $27,000.

Authorized capital	$1,000,000 00
Amount subscribed	645,100 00
Called capital	161,275 00
Amount paid up in cash	134,448 85

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

Cash value of real estate, less encumbrances	$ 15,125 35
Cash value of mortgages, exclusive of interest	93,356 84
Policy loans	20,447 66
Cash value (excluding interest and dividends) of stock, shares, bonds, debentures, etc.	103,985 00
Cash on hand at Head Office	3,223 77
Cash on deposit to the Company's credit and not drawn against on December 31st, 1918	11,828 92
Agents' balances	9,527 56
Premiums uncollected (net commissions deducted)	47,818 50
Bills receivable on premiums on capital stock	63,990 45
Interest due or accrued and unpaid	9,948 26
Office furniture (not extended), $4,337.	
Total assets	$379,252 31

Liabilities.

Claims or losses in suspense or reported	$ 28,467 53
Reinsurance reserve for life-insurance contracts in force	190,651 00
Amount of unpaid loans	37,000 00
Amount of all other liabilities	7,279 40
Total amount of liabilities	$263,397 93
Capital stock paid up in cash	134,448 85
Total of liabilities and paid-up capital	$397,846 78
Excess of liabilities	$ 18,594 47

Receipts.

Net premiums received in cash	$ 82,274 67
Cash received for interest	17,765 29
Cash received for calls on capital stock	2,782 30
Cash from all other sources	2,503 85
Cash received for debentures, mortgages, etc. (not extended), $11,610.14.	
Total receipts	$105,326 11

Expenditure.

Cash paid to agents for commission, salaries, and bonus	$ 28,153 70
„ for law costs	1,090 48
„ „ medical examiners' fees	3,298 50
„ „ interest, discount, and exchange	3,289 96
„ „ statutory assessment and licence fees	1,066 78
„ „ travelling expenses	361 20
„ „ rent and taxes	1,269 00
„ „ salaries, directors' and auditors' fees	14,004 00
„ „ printing, stationery, and advertising	3,521 32
„ „ postage, telegrams, and express	1,096 62
„ „ other expenses	7,393 62
Total expenses of management	$ 65,143 18
Net amount paid for losses	18,218 75
Cash paid for dividends to policyholders	775 93
Cash paid for other expenditure	1,448 00
Cash paid for debentures, mortgages, etc. (not extended), $52,256.69.	
Total expenditure	$ 85,585 86

RETURNS FOR BRITISH COLUMBIA.

Deposit with Government, Victory Loan bonds (par)	$ 27,000 00
Other assets (real estate, $15,125.35; mortgages, $13,000; loans, $1,021; cash, $460.33; agents' balances, $3,455.41)	33,062 09
Liabilities	7,883 00
Losses incurred, net	.....
Losses paid, net	.....
Net amount at risk	133,000 00

THE WORLD MARINE & GENERAL INSURANCE COMPANY, LIMITED.

Head Office—London, England.

Directors.

Major-General Sir Ivor Philipps, K.C.B., D.S.O., M.P., Chairman.

Herbert Ballard.	A. R. Marshall.
Norman S. Douglass.	Hon. J. C. Maxwell Scott.
John Godwin.	Sir John B. Wimble, K.B.E.

Irving H. Cortazzi, Secretary.

Capital authorized and subscribed	£250,000
Amount paid up	100,000

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

		£ s. d.
By Investments at cost	£800,925 1 7	
Yorkshire Insurance Company, Limited, 17,409 shares of £5 each, 10s. paid, at cost (£5)	87,045 0 0	
	£947,970 1 7	
Less special reserve against depreciation in value	43,000 0 0	
		904,970 1 7
Sundry debtors		142,063 18 7
Interest and dividends accrued		5,123 17 1
Cash at bankers, on deposit, and in hand		56,896 8 5
Policy stamps		245 6 5
Total assets		£1,109,299 12 1

Liabilities.

		£	s.	d.
To capital authorized, 50,000 shares of £5 each = £250,000.				
Capital issued, 50,000 shares of £5 each, £2 paid		100,000	0	0
Sundry creditors		109,344	4	6
Reserve Fund—				
As at December 31st, 1917	£120,000 0 0			
Amount added for the year ended December 31st, 1918	80,000 0 0			
		200,000	0	0
Underwriting Account balance		462,636	5	9
Profit and Loss Account balance	£322,319 1 10			
Less transfer to Reserve Fund	80,000 0 0			
	£242,319 1 10			
Less interim dividend paid, July 1st, 1918	5,000 0 0			
		237,319	1	10
Total liabilities		£1,109,299	12	1

THE YANG-TSZE INSURANCE ASSOCIATION, LIMITED.

Head Office—Shanghai, China.

Directors.

John Prentice, Chairman. A. W. Burkill.
C. W. Wrightson. H. E. Arnhold.
B. A. Clarke. A. I. D. Stewart.

T. A. Clark, Secretary.

Capital authorized and subscribed	$1,200,000 00
Amount paid up	720,000 00

STATEMENT FOR THE YEAR ENDED DECEMBER 31ST, 1918.

Assets.

British, Indian, and Colonial Government bonds and stocks	$ 810,389 88
Foreign Government bonds and stocks	289,530 17
British, Colonial, and Foreign railway and other stocks, bonds, and shares	1,259,600 15
Loans and mortgages	2,206,305 57
Cash at bankers on fixed deposit and current account	1,575,811 06
Property, land, Head Office, and other buildings	702,457 34
Policy stamps at agencies	1,241 15
Head Office and agencies, furniture	13,320 90
Due by agencies, premiums in course of collection, and sundry outstandings	574,302 42
Total assets	$7,432,958 64

Liabilities.

Capital, 12,000 shares of $100 each, upon which the sum of $60 per share has been called and fully paid up	$ 720,000 00
Reserve Fund	1,000,000 00
Reinsurance Reserve Fund	1,000,000 00
Building Reserve Fund	116,279 20
Working Account, 1918	2,614,060 14
Working Account, 1917 and former years	1,979,484 92
Uncollected dividends	3,134 38
Total liabilities	$7,432,958 64

NOTE.—Dollars are in Hong Kong currency, with sterling exchange standing at 5s. 2d.

LIST OF COMPANIES LICENSED UNDER THE "BRITISH COLUMBIA FIRE INSURANCE ACT," DECEMBER 31ST, 1918.

Name of the Company and Head Office.	Attorney to receive Process in British Columbia. (Corrected to July 10th, 1919.)
The Acadia Fire Insurance Company, Halifax, N.S.	F. W. Rounsefell, Vancouver.
Aetna Insurance Company, Hartford, Conn.	J. E. Kinsman, Victoria.
Agricultural Insurance Company, Watertown, N.Y.	R. G. Heddle, Vancouver.
Alliance Assurance Company, Limited, London, England	W. A. Anderson and H. Miskin, Vancouver.
Alliance Insurance Company of Philadelphia	G. F. Rennie, Vancouver.
*American Alliance Insurance Company, New York, N.Y.	O. D. Lampman, Vancouver.
American Central Insurance Company, St. Louis, Missouri	D. W. Campbell, Victoria.
Atlas Assurance Company, Limited, London, England	John S. Gall, Vancouver.
Beaver Fire Insurance Company, Winnipeg, Man.	Waghorn, Gwynn & Co., Ltd., Vancouver.
Boston Insurance Company, Boston, Mass.	A. Z. DeLong, Vancouver.
British America Assurance Company, Toronto, Ontario	P. R. Brown, Victoria.
British Colonial Fire Insurance Company, Montreal, Que.	E. B. McDermid, Vancouver.
British Crown Assurance Corporation, Ltd., Glasgow, Scotland	A. S. Matthew, Vancouver.
British North Western Fire Insurance Company, Winnipeg, Man.	F. Carter-Cotton, Vancouver.
British Traders' Insurance Company, Ltd., Victoria, Hong Kong	C. R. Elderton, Vancouver.
Caledonian Insurance Company, Edinburgh, Scotland	A. W. Jones, Victoria.
California Insurance Company, San Francisco, Cal.	A. W. Ross, Vancouver.
Canada Accident Assurance Co., Montreal, Que.	A. W. Ross, Vancouver.
Canada National Fire Insurance Company, Winnipeg, Man.	R. W. Perry, Victoria.
Canadian Fire Insurance Company, Winnipeg, Man.	F. C. Paterson, Victoria.
Car & General Insurance Corporation Limited, London, Eng.	J. H. Lawson, Vancouver.
The Century Insurance Company, Limited, Edinburgh, Scotland	Thos. W. Greer, Vancouver.
Citizens Insurance Company of Missouri, St. Louis, Mo.	D. E. Brown, Vancouver.
Commercial Union Assurance Company, Limited, London, England	A. W. Ross, Vancouver.
Commercial Union Fire Insurance Company of New York	A. W. Ross, Vancouver.
Connecticut Fire Insurance Company, Hartford, Conn.	Robt. H. Swinerton, Victoria.
Continental Insurance Company, New York, N.Y.	W. A. Lawson, Vancouver.
Dominion Fire Insurance Company, Toronto, Ontario	G. H. L. Hobson, Vancouver.
The Dominion of Canada Guarantee & Accident Insurance Company, Toronto, Ont.	E. P. Withrow, Vancouver.
The Eagle, Star & British Dominions Insurance Co., Ltd., London, England	R. J. Loewen and R. G. Harvey, Vancouver.
Employers Liability Assurance Corporation, Limited, London, Eng.	Jas. A. Young.
Equitable Fire & Marine Insurance Company, Providence, R.I.	A. M. Pound, Vancouver.
Fidelity Phenix Fire Insurance Company, New York, N.Y.	Arthur Coles, Victoria.
Fire Association of Philadelphia, Philadelphia, Pa.	Leeming Bros., Ltd., Victoria.
The Fire Insurance Company of Canada, Montreal, Quebec	C. G. Hobson, Vancouver.
Fireman's Fund Insurance Company, San Francisco, Cal.	E. D. Todd, Victoria.
Firemen's Insurance Company of Newark, New Jersey	Alexander Dow, Vancouver.
General Accident Fire & Life Assurance Corporation, Limited, Perth, Scotland	E. J. Enthoven, Vancouver.
General Fire Assurance Company, Paris, France	W. S. Holland, Vancouver.
Glens Falls Insurance Company, Glens Falls, N.Y.	G. L. Hobson, Vancouver.
Globe & Rutgers Fire Insurance Company, New York, N.Y.	H. Bell-Irving & Co., Ltd., Vancouver.
Globe Indemnity Co. of Canada, Montreal, Que.	F. W. Rounsefell, Vancouver.
Great American Insurance Company, New York, N.Y.	W. A. Wand, Vancouver.
Guardian Assurance Company, Limited, London, England	R. S. Day, Victoria.
Hartford Fire Insurance Company, Hartford, Conn.	George Allan Kirk, Victoria.
Home Insurance Company, New York, N.Y.	H. W. Dyson, Vancouver.
Hudson Bay Insurance Company, Montreal, Que.	F. W. Walker, Vancouver.
†Imperial Guarantee & Accident Insurance Company of Canada, Toronto, Ont.	Donald Cramer, Vancouver.
Imperial Underwriters Corporation of Canada, Toronto	A. Waring Giles, Vernon.
Insurance Company of North America, Philadelphia, Pa.	G. F. Rennie, Vancouver.
The Insurance Company of the State of Pennsylvania, Philadelphia, Pa.	H. A. Robertson, Vancouver.
Law, Union & Rock Insurance Company, Limited, London, England	R. S. Day, Victoria.
Liverpool & London & Globe Insurance Company, Limited, Liverpool, England	R. C. Hall, Victoria.
Liverpool-Manitoba Assurance Company, Montreal, Quebec	L. U. Conyers, Victoria.
London Assurance Corporation, London, England	Harold B. Girdwood, Victoria.
London & Lancashire Fire Insurance Company, Ltd., Liverpool, England	Wm. Thompson, Vancouver.
London Guarantee & Accident Co., Ltd., London, England	J. H. Watson, Vancouver.
London Mutual Fire Insurance Company of Canada, Toronto, Ont.	Christopher G. Hobson, Vancouver.
‡Marine Insurance Company, Limited, London, England	W. W. Johnston, Vancouver.
Mechanics & Traders Insurance Company, New Orleans, La.	W. S. Holland, Vancouver.
Mercantile Fire Insurance Company, Waterloo, Ontario	Wm. Thompson, Vancouver.
Merchants Fire Assurance Corporation of New York, N.Y.	C. G. Hobson, Vancouver.
Millers National Insurance Company, Chicago, Ill.	C. G. Hobson, Vancouver.
Mount Royal Assurance Company, Montreal, Quebec	C. G. Hobson, Vancouver.
National Ben Franklin Fire Insurance Company, Pittsburgh, Pa.	J. H. Johnston, Victoria.
National Benefit Assurance Co., Ltd., London, Eng.	B. J. Jayne, Vancouver.
National Fire Insurance Company of Hartford, Hartford, Conn.	H. T. Barnes, Victoria.
The Nationale Fire Insurance Company, Paris, France	C. G. Hobson, Vancouver.
National Union Fire Insurance Company, Pittsburgh, Pa.	E. E. Rand, Vancouver.
Newark Fire Insurance Company, Newark, N.J.	F. W. Walker, Vancouver.
New Hampshire Fire Insurance Co., Manchester, N.H.	A. Z. DeLong, Vancouver.
New Jersey Fire Insurance Company, Newark, N.J.	H. A. Robertson, Vancouver.
Niagara Fire Insurance Company, New York, N.Y.	D. Leeming, Victoria.
Northern Assurance Company, Limited, London, England	Bernard C. Mess, Victoria.
§The North American Accident Insurance Co., Montreal, Quebec	J. Edward Sears, Vancouver.
North British & Mercantile Insurance Company, London, Eng.	E. E. Hill, Vancouver.
North Empire Fire Insurance Company, Winnipeg, Manitoba	John W. Wilson, Vancouver.

LIST OF COMPANIES LICENSED UNDER THE "BRITISH COLUMBIA FIRE INSURANCE ACT"—*Concluded.*

Name of the Company and Head Office.	Attorney to receive Process in British Columbia. (Corrected to July 10th, 1919.)
North West Fire Insurance Company, Winnipeg, Manitoba	Chas. H. C. Payne, Victoria.
Northwestern Mutual Fire Association, Seattle, Washington	N. B. Whitley, Vancouver.
Northwestern National Insurance Company, Milwaukee, Wis.	W. B. Blane, Vancouver.
Norwich Union Fire Insurance Society, Limited, Norwich, England	B. S. Heisterman, Victoria.
Ocean Accident & Guarantee Corporation, Limited, London, England	John R. Hannah, Vancouver.
Occidental Fire Insurance Company, Winnipeg, Manitoba	A. E. Short, Vancouver.
Pacific Coast Fire Insurance Company, Vancouver, B.C.	Thos. W. Greer, Vancouver.
Palatine Insurance Company, Limited, London, England	A. W. Ross, Vancouver.
The Phenix Fire Insurance Company of Paris, France	J. A. Griffith, Victoria.
Phoenix Assurance Company, Limited, London, England	F. W. Rounsefell, Vancouver.
The Phoenix Insurance Company, Hartford, Conn.	Arthur E. Haynes, Victoria.
Providence Washington Insurance Company, Providence, R.I.	Richard W. Douglas, Vancouver.
Provincial Insurance Co., Ltd., Bolton, England	A. Z. DeLong, Vancouver.
Quebec Fire Assurance Company, Quebec, Que.	Wm. Thompson, Vancouver.
Queen Insurance Company of America, New York	R. P. Rithet & Co., Ltd., Victoria.
Queensland Insurance Company, Limited, Sydney, Australia	C. Gardner-Johnson, Vancouver.
*Rhode Island Insurance Company, Providence, R.I.	H. T. Devine & Co., Ltd., Vancouver.
Royal Exchange Assurance, London, England	H. G. Lawson, Jr., Victoria.
Royal Insurance Company, Limited, Liverpool, England	F. W. Walker, Vancouver.
St. Paul Fire & Marine Insurance Company, St. Paul, Minn.	B. S. Heisterman, Victoria.
Scottish Union & National Insurance Company, Edinburgh, Scotland	Pemberton & Son, Victoria.
Springfield Fire & Marine Insurance Company, Springfield, Mass.	Chas. H. Macaulay, Vancouver.
Stuyvesant Insurance Company, New York, N.Y.	H. A. Robertson, Vancouver.
Sun Insurance Office, London, England	F. B. Pemberton, Victoria.
Union Assurance Society, Limited, London, England	D. C. McGregor, Vancouver.
The Union Fire Insurance Company, Paris, France	Franco-Canadian Trust & Mortgage Co., Vancouver.
Union Insurance Society of Canton, Ltd., Victoria, Hong Kong	C. R. Elderton, Vancouver.
‖Union Marine Insurance Company, Limited, Liverpool, England	C. H. Macaulay, Vancouver.
Vulcan Fire Insurance Company of Oakland, Cal.	T. W. Greer, Vancouver.
Western Assurance Company, Toronto, Ontario	R. W. Douglas, Vancouver.
Westchester Fire Insurance Company, New York, N.Y.	R. N. Ferguson, Victoria.
Yorkshire Insurance Company, Limited, York, England	H. W. Dyson, Vancouver.

* Approved bond for $25,000 deposited as security under the Act.

† Licence under "B.C. Fire Insurance Act," limited to insurance of automobiles against fire; also licensed under the "Insurance Act" to transact guarantee, accident, sickness, automobile, and plate-glass insurance.

‡ Licence under "B.C. Fire Insurance Act," limited to insuring automobiles against loss or damage by fire; also licensed under the "Insurance Act" to transact automobile and inland transportation insurance.

§ Licence under "B.C. Fire Insurance Act," limited to insuring automobiles against loss or damage by fire; also licensed under the "Insurance Act" to transact automobile, burglary, accident, sickness, and plate-glass insurance.

‖ Licence under "B.C. Fire Insurance Act," limited to insuring automobiles against loss or damage by fire; also licensed under the "Insurance Act" to transact marine, inland marine, inland transportation, automobile, and accident insurance.

NOTE.—Licensed since December 31st, 1918:—
Canadian Surety Company, Toronto, Ont.; Wm. Savage, Vancouver.
General Accident Assurance Co. of Canada, Montreal, Quebec; George Rorie, Vancouver.
Guardian Insurance Company of Canada, Montreal, Quebec; R. G. Heddle, Vancouver.
Scottish Metropolitan Assurance Co., Ltd., Edinburgh, Scotland; Lawrence W. Peel, Vancouver.
United States Fire Insurance Co., New York, N.Y.; H. A. Robertson, Vancouver.

LIST OF COMPANIES LICENSED UNDER THE "INSURANCE ACT," DECEMBER 31ST, 1918.

Name of Company and Head Office.	Attorney to receive Process in British Columbia. (Corrected to July 10th, 1919.)	Description of Insurance Business for which Licensed. (Corrected to July 10th, 1919.)
Aetna Insurance Co., Hartford, Conn.	J. E. Kinsman, Victoria	*Automobile and marine.
Alliance Assurance Co., Ltd., London, Eng.	W. Anderson and H. Miskin, Vancouver	*Marine, accident, sickness, guarantee, automobile, burglary, plate glass, and
The Boiler Inspection & Insurance Co. of Canada, Toronto, Ont.	R. V. Winch & Co., Ltd., Vancouver	Steam-boiler. [hail.
Boston Insurance Co., Boston, Mass.	A. Z. DeLong, Vancouver	*Marine.
The British and Foreign Marine Insurance Co., Ltd., Liverpool, Eng.	B. C. Mess, Victoria	Marine, inland transportation, sprinkler leakage.
British America Assurance Co., Toronto, Ont.	P. R. Brown, Victoria	*Hail, ocean, marine, inland marine, inland transportation, and automobile.
(1.) The British Columbia Plate Glass Insurance Co., Vancouver, B.C.	Head Office, Vancouver	Plate glass.
British Crown Assurance Corporation, Ltd., Glasgow, Scotland	A. S. Matthew, Vancouver	Automobile (excluding insurance against loss by reason of bodily injury to the person).
British Traders Insurance Co., Ltd., Victoria, Hong Kong	C. R. Elderton, Vancouver	*Automobile and marine.
The Canada Accident Assurance Co., Montreal, Que.	A. W. Ross, Vancouver	*Accident, sickness, plate glass, and guarantee.
Canada Life Assurance Co., Toronto, Ont.	F. W. Marsh, Vancouver	Life.
The Canadian Surety Co., Toronto, Ont.	William Savage, Vancouver	Guarantee, burglary, plate glass, and automobile.
The Canton Insurance Office, Limited, Victoria, Hong Kong	Wm. Monteith & Co., Ltd., Victoria	Marine.
The Capital Life Assurance Co. of Canada, Ottawa, Ont.	W. D. Kennedy, Vancouver	Life.
Car and General Insurance Corporation, Ltd., London, Eng.	J. H. Lawson, Vancouver	*Accident, hail, automobile, and sickness.
Confederation Life Association, Toronto, Ont.	J. L. Kerr, Vancouver	Life.
Continental Casualty Co., Hammond, Ind.	A. S. Matthew, Vancouver	Accident, sickness, and automobile.
The Continental Life Insurance Co., Toronto, Ont.	N. B. Bailey, Vancouver	Life.
The Crown Life Insurance Co., Toronto, Ont.	F. R. McD. Russell, Vancouver	Life.
The Dominion of Canada Guarantee & Accident Ins. Co., Toronto, Ont.	E. P. Withrow, Vancouver	*Accident, guarantee, sickness, burglary, and plate glass.
Dominion Gresham Guarantee & Casualty Co., Montreal, Que.	H. T. Devine, Vancouver	Accident, sickness, guarantee, burglary, and automobile.
The Dominion Life Assurance Co., Waterloo, Ont.	F. W. Parkin, Vancouver	Life.
The Eagle Star & British Dominions Insurance Co., Ltd., London, Eng.	R. J. Loewen and R. G. Harvey, Vancouver.	*Marine.
Employers Liability Assurance Corporation, Ltd., London, Eng.	Jas. A. Young, Vancouver	*Accident, sickness, guarantee, automobile, burglary, steam-boiler, and plate glass.
Equitable Fire & Marine Insurance Co., Providence, R.I.	A. M. Pound, Vancouver	*Automobile (excluding insurance against loss by reason of bodily injury to the person).
The Equitable Life Assurance Society of U.S., New York, N.Y.	J. H. Campbell, Vancouver	Life.
The Excelsior Life Insurance Co., Toronto, Ont.	F. J. Gillespie, Vancouver	Life.
The Fidelity & Casualty Co., New York, N.Y.	Seeley & Co., Vancouver	Accident, sickness, burglary, steam-boiler, and plate glass.
Fireman's Fund Insurance Co., San Francisco, Cal.	E. D. Todd, Victoria	*Marine, inland transportation, and insurance against loss or damage to automobiles by accident, burglary, or theft.
General Accident Assurance Co. of Canada, Toronto, Ont.	G. E. Rodwell, Vancouver	Accident, sickness, steam-boiler, and guarantee.
General Animals Insurance Co. of Canada, Montreal, Que.	R. W. Douglas, Vancouver	Live stock.
Globe Indemnity Co. of Canada, Montreal, Que.	F. W. Rounsefell, Vancouver	*Accident, sickness, burglary, automobile, and guarantee.
Great American Insurance Co., New York, N.Y.	W. A. Wand, Vancouver	*Hail, tornado, sprinkler leakage, marine and auto (excluding insurance against loss by reason of bodily injury).
(2.) Great North Insurance Company, Calgary, Alta.	J. Edward Bird, Vancouver	Live stock.
The Great West Life Assurance Co., Winnipeg, Man.	J. A. Johnson, Vancouver	Life.
Gresham Life Assurance Society, Ltd., London, Eng.	H. E. Boorman, Vancouver	Life.
The Guarantee Company of North America, Montreal, Que.	C. A. Holland, Victoria	Guarantee.
Guardian Insurance Co. of Canada, Montreal, Que.	W. E. Graveley, Vancouver	Accident, sickness, guarantee, plate glass, burglary, and automobile.
Home Insurance Co., New York, N.Y.	H. W. Dyson, Vancouver	*Automobile, sprinkler leakage, hail, tornado, and explosion (including riot and civil commotion).
Imperial Guarantee & Accident Insurance Co. of Canada, Toronto, Ont.	D. Cramer, Vancouver	Guarantee, accident, sickness, automobile, and plate glass. (Also licensed under "B.C. Fire Insurance Act" to transact the business of insurance of automobiles against fire.)
Imperial Life Assurance Co. of Canada, Toronto, Ont.	Stanley Henderson, Vancouver	Life.
Insurance Company of North America, Philadelphia, Pa.	G. F. Rennie, Vancouver	*Inland transportation, automobile (excluding injury to the person), marine, and explosion (including riot and civil commotion).
Law, Union & Rock Insurance Co., Ltd., London, Eng.	R. S. Day, Victoria	*Accident and sickness.
Lloyds Plate Glass Insurance Co., New York, N.Y.	C. A. MacMorran, Vancouver	Plate glass.
London Assurance Corporation, London, Eng.	R. V. Winch & Co., Ltd., Victoria	*Marine.
London Guarantee & Accident Co., Ltd., London, Eng.	J. H. Watson, Vancouver	*Accident, sickness, guarantee, and burglary.
The London Life Insurance Co., London, Ont.	William B. Ryan, Victoria	Life.
The London & Lancashire Guarantee & Accident Co. of Canada, Toronto, Ont.	Wm. Thompson, Vancouver	Accident, sickness, guarantee, plate glass, and automobile.
The London & Lancashire Life & General Assurance Association, Ltd., London, Eng.	H. J. Woodley, Vancouver	Life.
London & Provincial Marine & General Insurance Co., Ltd., London, Eng.	R. V. Winch & Co., Ltd., Victoria	Marine.
Loyal Protective Insurance Co., Boston, Mass.	G. H. Grant, Vancouver	Accident and sickness amongst members of I.O.O.F.
The Manufacturers Life Insurance Co., Toronto, Ont.	W. B. Barwis, Vancouver	Life.
The Marine Insurance Co., Ltd., London, Eng.	W. W. Johnston, Vancouver	Inland transportation and automobile. (Also licensed under "B.C. Fire Insurance Act" to insure automobiles against loss or damage by fire.)
Maritime Insurance Co., Ltd., Liverpool, Eng.	R. P. Rithet & Co., Ltd., Victoria	Marine.
Maryland Assurance Corporation, Baltimore, Md.	L. A. Genge, Victoria	Accident and sickness.
Maryland Casualty Co., Baltimore, Maryland	J. H. Lawson, Victoria	Accident, burglary, guarantee, plate glass, and steam-boiler.
Merchants Casualty Co., Winnipeg, Man.	J. B. Love, Vancouver	Accident (excluding employers' liability) and sickness.
Metropolitan Life Insurance Co., New York, N.Y.	Wm. Murphy, Victoria	Life.
The Monarch Life Assurance Co., Winnipeg, Man.	R. W. Harris, Vancouver	Life.
Mutual Life Assurance Co. of Canada, Waterloo, Ont.	W. J. Twiss, Vancouver	Life.
The Mutual Life Insurance Co. of New York, N.Y.	A. Callander, Vancouver	Life.
National Life Assurance Co. of Canada, Toronto, Ont.	Lindley Crease, Victoria	Life.
National Provincial Plate Glass & General Insurance Co., Ltd., London, Eng.	F. W. Rounsefell, Vancouver	Plate glass.
National Surety Co., New York, N.Y.	R. V. Winch, Vancouver	Guarantee.
Niagara Fire Insurance Co., New York, N.Y.	D. Leeming, Victoria	*Tornado, automobile (including damage to automobiles in transit by rail), marine, and explosion (including riot and civil commotion).
New York Life Insurance Co., New York, N.Y.	Milo Phelps, Vancouver	Life.
New York Plate Glass Insurance Co., New York, N.Y.	A. S. Matthew, Vancouver	Plate glass.
The North American Accident Insurance Co., Montreal	J. E. Sears, Vancouver	*Accident, sickness, plate glass, automobile, and burglary.
North American Life Assurance Co., Toronto, Ont.	Ellis W. Keenleyside, Vancouver	Life.
Northern Life Assurance Co. of Canada, London, Ont.	W. H. Clarke, Vancouver	Life.
Northwestern National Insurance Co., Milwaukee, Wis.	J. Edward Sears, Vancouver	*Automobile.
Norwich Union Fire Insurance Society, Ltd., Norwich, Eng.	B. S. Heisterman, Victoria	*Accident, sickness, plate glass, automobile.
Norwich Union Life Insurance Society, Norwich, Eng.	B. S. Heisterman, Victoria	Life.
The Ocean Accident & Guarantee Corporation, Ltd., London, Eng.	J. R. Hannah, Vancouver	*Accident, sickness, guarantee, plate glass, automobile, and burglary.
Ocean Marine Insurance Co., Ltd., London, Eng.	R. V. Winch & Co., Ltd., Victoria	Marine.
Phoenix Assurance Co., Ltd., London, Eng.	F. W. Rounsefell, Vancouver	*Life.
Phoenix Insurance Co., Hartford, Conn.	A. E. Haynes, Victoria	*Marine and automobile (excluding insurance against loss by reason of injury to the person).
Protective Association of Canada, Granby, Que.	F. G. Bell, Vancouver	Accident and sickness restricted to members of the Masonic Order.
The Prudential Insurance Co. of America, Newark, N.J.	Chas. Preston, Vancouver	Life.
Queen Insurance Co. of America, New York, N.Y.	R. P. Rithet & Co., Ltd., Victoria	*Automobile and inland transportation.
Queensland Insurance Co., Ltd., Sydney, Australia	C. Gardiner Johnson, Vancouver	Marine.
Railway Passengers Assurance Co., London, Eng.	British American Trust Co., Vancouver	Accident, sickness, guarantee, plate glass, and automobile.
The Ridgely Protective Association, Worcester, Mass.	John Dunlop, Nelson	Accident and sickness amongst members of I.O.O.F.
Reliance Marine Insurance Co., Liverpool, Eng.	R. P. Rithet & Co., Ltd., Victoria	Marine.
Royal Exchange Assurance, London, Eng.	H. G. Lawson, Jr., Victoria	*Accident, sickness, automobile (restricted to loss from the automobile by burglary or theft).
Royal Insurance Co., Ltd., Liverpool, Eng.	F. W. Walker, Vancouver	*Life and marine.
(3.) Royal Plate Glass Insurance Company of Canada, Vancouver, B.C.	Head Office, Vancouver	Plate glass.
St. Paul Fire & Marine Insurance Co., St. Paul, Minn.	B. S. Heisterman, Victoria	*Automobile, inland transportation, and marine.
Scottish Union & National Insurance Co., Edinburgh, Scotland	F. B. Pemberton, Victoria	Tornado, sprinkler leakage, and automobile.
The Sovereign Life Assurance Co., Winnipeg, Man.	A. C. Stewart, Vancouver	Life.
The Standard Life Assurance Co., Edinburgh, Scotland	J. W. Kerr, Vancouver	Life.
Standard Marine Insurance Co., Ltd., Liverpool, Eng.	C. Gardner Johnson, Vancouver	Marine.
Sun Life Assurance Co. of Canada, Montreal, Que.	N. O. Leach, Vancouver	Life.
Tokio Marine & Fire Insurance Co., Tokio, Japan	B. G. D. Phillips, Vancouver	Marine.
Travelers Indemnity Company, Hartford, Conn.	R. C. Hall, Victoria	Accident, sickness, steam-boiler, plate glass, burglary, automobile, fly-wheel.
The Travelers Insurance Co., Hartford, Conn.	R. C. Hall, Victoria	Life and accident.
Travellers Life Assurance Co. of Canada, Montreal, Que.	J. D. Mather, Vancouver	Life.
Union Insurance Society of Canton, Ltd., Victoria, Hong Kong	C. R. Elderton, Vancouver	*Marine and automobile.
Union Marine Insurance Company, Ltd., Liverpool, Eng.	C. H. Macaulay, Vancouver	Marine, inland marine, inland transportation, accident, automobile. (Also licensed under "B.C. Fire Insurance Act" to insure automobiles against loss or damage by fire.)
Union Mutual Life Insurance Co., Portland, Maine	Viggo F. Laursen, Vancouver	Life.
United States Fidelity & Guaranty Co., Baltimore, Md.	Leslie H. Wright, Vancouver	Guarantee, accident, sickness, burglary, plate glass, and steam-boiler.
Western Assurance Company, Toronto, Ont.	R. W. Douglas, Vancouver	*Marine, inland transportation, explosion (including riot and civil commotion), tornado, and automobile.
(4.) Western Empire Life Assurance Co., Winnipeg, Man.	C. Wilson, Vancouver	Life.
Western Life Assurance Co., Winnipeg, Man.	H. R. King, Vancouver	Life.
The World Marine & General Insurance Co., Ltd., London, Eng.	B. C. Mess, Victoria	Marine.
The Yang Tsze Insurance Association, Ltd., Shanghai, China	B. G. D. Phillips, Vancouver	Marine.
Yorkshire Insurance Co., Ltd., York, Eng.	H. W. Dyson, Vancouver	*Accident, sickness, plate glass, and live stock.

* Also licensed under "B.C. Fire Insurance Act" to transact fire insurance.

Securities (par value) deposited under the Act:—
(1.) War Loan Bonds, $1,000; Municipal Securities, $5,000; B.C. Inscribed Stock, $973.32.
(2.) Cash, $5,000.
(3.) Dominion War Loan Bonds, $5,000, and deposit receipt, Canadian Bank of Commerce, $125.
(4.) Dominion War Loan Bonds, $27,000.

NOTE.—Licensed since December 31st, 1918:—
Aetna Life Insurance Co., Hartford, Conn.; attorney, John F. Brandt, Vancouver; to transact life insurance.
American Alliance Insurance Co., New York, N.Y.; attorney, O. D. Lampman, Vancouver; to transact automobile insurance (excluding insurance against loss by reason of injury to the person).
Newark Fire Insurance Co., Newark, N.J.; attorney, F. W. Walker, Vancouver; to transact marine and automobile insurance (excluding insurance against loss by reason of injury to the person).
New Zealand Insurance Co., Ltd., Auckland, N.Z.; attorney, J. T. Summerfield, Vancouver; to transact marine insurance.
Northern Assurance Co., Ltd., London, Eng.; attorney, R. V. Winch & Co., Ltd., Vancouver; to transact marine insurance.
Scottish Metropolitan Assurance Co., Ltd., Edinburgh, Scotland; attorney, Lawrence W. Peel, Vancouver; to transact accident, sickness, guarantee, and automobile insurance.
United States Lloyds, Inc., New York, N.Y.; attorney, B. G. D. Phillips, Vancouver; to transact marine insurance.
Western Casualty Co., Denver, Col.; attorney, W. H. Biegel, Vancouver; to transact accident and sickness insurance.

TABLE I.—NET FIRE INSURANCE PREMIUMS AND NET LOSSES, 1918.

Name of Company.	Net Premiums.	Net Amount of Losses incurred.	Net Amount of Losses paid.
Acadia Fire Insurance Co.	$ 26,941 79	$ 8,889 57	$ 10,066 61
Aetna Insurance Co.	63,170 23	2,704 16	2,542 39
Agricultural Insurance Co.	12,469 83	2,895 53	2,778 26
Alliance Assurance Co., Ltd.	29,387 55	3,114 85	2,857 85
Alliance Insurance Co. of Philadelphia	21,445 15	6,766 61	6,265 02
American Alliance Insurance Co.	6,501 36	2,089 57	1,583 57
American Central Insurance Co.	13,309 72	1,454 81	1,459 18
Atlas Assurance Co., Ltd.	27,951 99	5,755 70	5,755 70
Beaver Fire Insurance Co.	4,731 96	30 00	708 94
Boston Insurance Co.	36,662 70	23,716 10	20,878 28
British America Assurance Co.	64,868 54	21,103 53	17,171 02
British Colonial Fire Insurance Co.	16,168 21	8,465 41	8,465 41
British Crown Assurance Corporation	54,614 57	17,720 54	19,490 54
British Northwestern Fire Insurance Co.	5,008 31	*Nil.*	391 73
British Traders Insurance Co., Ltd	14,614 01	444 19	444 19
Caledonian Insurance Co.	43,399 34	5,378 35	5,301 35
California Insurance Co.	28,031 41	12,925 07	7,415 07
Canada Accident Assurance Co.	19,442 54	11,673 06	5,179 22
Canada National Fire Insurance Co	36,388 47	7,006 45	6,006 45
Canadian Fire Insurance Co.	22,682 44	3,889 18	6,768 61
Century Insurance Co., Ltd.	23,272 53	2,794 80	3,012 02
Citizens Insurance Co. of Missouri	32,912 51	2,935 65	2,939 64
Commercial Union Assurance Co., Ltd.	114,441 90	45,080 10	33,959 77
Commercial Union Fire Insurance Co. of N.Y.	8,388 29	1,730 83	1,729 27
Connecticut Fire Insurance Co.	44,689 05	15,484 01	12,961 28
Continental Insurance Co.	40,768 99	9,256 84	9,251 72
Dominion Fire Insurance Co.	10,080 97	1,573 99	1,573 99
Dominion of Canada Guarantee & Accident Insurance Co.	2,125 01	*Nil.*	1 05
Eagle Star & British Dominions Insurance Co., Ltd.	31,174 16	164 97	163 77
Employers Liability Assurance Corporation	55,798 88	11,647 83	12,278 05
Equitable Fire & Marine Insurance Co.	7,885 31	6,136 67	5,004 67
Fidelity Phenix Fire Insurance Co.	56,028 41	11,173 43	11,149 05
Fire Association of Philadelphia	24,707 84	13,572 01	12,221 68
Fireman's Fund Insurance Co.	67,516 32	14,021 25	5,099 90
Firemen's Insurance Co.	14,797 99	21,326 00	2,257 55
General Accident Fire & Life Insurance Co.	25,404 34	3,304 30	694 49
General Fire Assurance Co. of Paris	17,358 19	6,374 25	6,373 25
Glens Falls Insurance Co.	37,372 30	6,410 11	5,785 11
Globe & Rutgers Fire Insurance Co.	49,698 86	12,721 85	6,941 62
Globe Indemnity Co. of Canada	11,235 43	1,077 50	1,027 50
Great American Insurance Co.	49,786 76	18,717 77	22,894 77
Guardian Assurance Co., Ltd.	102,119 67	14,264 98	16,116 69
Hartford Fire Insurance Company	91,577 59	30,141 14	26,734 25
Home Insurance Company	75,451 91	12,884 72	13,640 72
Hudson Bay Insurance Company	40,154 47	25,434 89	25,414 89
Imperial Guarantee & Accident Insurance Co.	3,262 69	423 20	442 82
Imperial Underwriters Corporation	50,623 05	4,489 04	4,738 04
Insurance Co. of North America	74,380 92	24,386 33	21,238 80
Insurance Co. of State of Pennsylvania	40,461 41	14,304 61	13,302 08
Law Union & Rock Insurance Co., Ltd.	14,182 56	5,082 10	3,935 43
Liverpool & London & Globe Insurance Co.	158,217 65	14,449 74	20,455 34
Liverpool-Manitoba Assurance Co.	41,038 95	30,440 94	28,731 52
London & Lancashire Fire Insurance Co.	99,193 73	13,176 09	10,309 09
London Assurance Corporation	76,510 01	20,359 07	20,077 07
London Guarantee & Accident Co., Ltd.	24,241 81	10,542 04	3,551 85
London Mutual Fire Insurance Co.	41,420 95	7,558 07	8,562 36
Mechanics & Traders Insurance Co.	25,018 77	16,493 33	15,293 33
Mercantile Fire Insurance Co.	23,734 09	10,131 86	9,621 86
Merchants Fire Assurance Corporation	17,116 57	3,446 71	3,446 71
Millers National Insurance Co.	4,969 49	1,039 14	1,034 34
Mount Royal Assurance Co.	49,869 54	9,013 93	9,170 78
National Ben Franklin Fire Insurance Co.	16,143 24	4,135 73	4,035 05
National Benefit Assurance Co., Ltd.	1,677 88	4,200 00	100 00
National Fire Insurance Co. of Hartford	88,461 52	13,104 42	9,720 42
Nationale Fire Insurance Co.	31,506 55	5,680 95	4,724 43
National Union Fire Insurance Co.	18,648 62	13,215 99	15,038 62
Newark Fire Insurance Co.	11,045 73	5,728 32	5,747 82
New Hampshire Fire Insurance Co.	11,757 55	2,098 28	2,087 71
New Jersey Fire Insurance Co.	36,680 27	20,809 12	20,522 52
Niagara Fire Insurance Co.	42,250 45	16,232 32	15,956 32
Northern Assurance Co.	91,732 05	7,124 00	7,152 00
North American Accident Insurance Co.	277 66	*Nil.*	*Nil.*
North British & Mercantile Insurance Co.	67,005 38	7,345 34	6,736 09
North Empire Fire Insurance Co.	16,910 61	2,266 92	2,266 92
North West Fire Insurance Co.	10,221 19	2,194 83	2,014 54
Northwestern Mutual Fire Association	15,294 14	2,250 58	2,250 58
Northwestern National Insurance Co.	24,180 08	7,326 61	7,326 61
Norwich Union Fire Insurance Society	73,080 77	21,825 14	19,621 35
Ocean Accident & Guarantee Corporation	11,670 34	1,814 53	1,829 53
Occidental Fire Insurance Co.	9,868 97	96 03	506 05
Pacific Coast Fire Insurance Co.	26,950 87	4,161 07	4,500 71
Palatine Insurance Co., Ltd.	36,887 61	20,225 77	14,495 66
Phenix Fire Insurance Co.	14,931 39	5,852 49	5,852 49
Phoenix Assurance Co.	242,867 18	55,774 24	66,367 71
Carried forward	$2,326,759 99	$619,588 77	$544,667 56

TABLE I.—NET FIRE INSURANCE, ETC.—*Concluded.*

Name of Company.	Net Premiums.	Net Amount of Losses incurred.	Net Amount of Losses paid.
Brought forward	$2,326,759 99	$619,588 77	$544,667 56
Phoenix Insurance Co., Ltd.	53,242 51	42,897 41	39,002 07
Providence Washington Insurance Co	24,555 62	17,367 70	15,495 66
Provincial Insurance Co., Ltd	6,805 20	362 21	447 41
Quebec Fire Assurance Co.	29,432 81	2,996 53	2,996 53
Queen Insurance Co. of America	74,767 99	36,463 77	36,313 77
Queensland Insurance Co., Ltd	10,359 86	4,350 83	3,350 83
Royal Exchange Assurance	55,983 03	34,921 10	35,115 40
Royal Insurance Co., Ltd.	115,137 32	52,500 70	53,629 70
St. Paul Fire & Marine Insurance Co.	27,163 35	6,537 69	4,748 16
Scottish Union & National Insurance Co	57,443 33	25,227 74	25,113 74
Springfield Fire & Marine Insurance Co	48,674 25	14,168 85	15,065 08
Stuyvesant Insurance Co	21,191 83	3,884 99	5,786 25
Sun Insurance Office	69,295 47	9,124 16	9,124 16
Union Assurance Society, Ltd.	59,030 79	19,829 31	16,393 31
Union Fire Insurance Co. of Paris	21,070 68	12,761 62	12,761 62
Union Insurance Co. of Canton, Ltd	51,269 11	37,199 70	32,983 68
Vulcan Fire Insurance Co.	6,163 54	1,514 55	1,513 95
Western Assurance Co	63,483 57	23,999 61	25,780 87
Westchester Fire Insurance Co	35,497 19	10,152 14	7,482 31
Yorkshire Insurance Co., Ltd.	27,822 19	14,850 59	14,120 61
Total	4,085,219 68	1,214,162 65	1,120,475 80

TABLE II.—FIRE INSURANCE SUMMARY.

Year.	Net Premiums.	Net Amount of Losses incurred.	Net Amount of Losses paid.
1914	$ 3,592,878 30	$1,696,780 49	$1,542,845 20
1915	3,180,168 66	1,176,335 11	1,313,759 23
1916	3,121,885 87	1,378,764 79	1,290,641 50
1917	4,609,442 65	887,639 01	958,460 60
1918	4,085,219 68	1,214,162 65	1,120,475 80
Totals	$17,589,595 16	$6,354,182 05	$6,226,182 33

TABLE III.—DISPOSITION OF PREMIUMS RECEIVED.

	1916.	1917.	1918.
Rate of losses paid per cent. of premiums received	55.74	53.58	54.94
Rate of dividend or bonus to stockholders per cent. of premiums received (Canadian companies only)	3.93	7.90	2.77
Rate of general expenses per cent. of premiums received	34.85	32.94	36.17
Rate of premiums charged per cent. of risks taken	1.01	1.006	1.00

NOTE.—The figures are taken from the reports of the Superintendent of Insurance for the Dominion for 1917-8-9, and cover the business throughout Canada of the companies to which they refer.

TABLE IV.—RATIO OF LOSSES INCURRED TO PREMIUMS WRITTEN IN THE VARIOUS PROVINCES.

Provinces.	1918.	1917.	1916.
Alberta	43.86	32.87	47.90
British Columbia	28.93	25.40	45.00
Manitoba	60.89	59.15	52.09
New Brunswick	41.90	59 54	60.50
Nova Scotia	51.33	69.29	50.16
Ontario	57.99	62.77	77.46
Prince Edward Island	20.89	48.52	210.13
Quebec	52.81	60.98	49.18
Saskatchewan	48.04	44.44	39.72
Yukon	25.27	5.26	.....
	50.91	55.62	58.78

NOTE.—The figures are abstracted from the report for 1918 of the Superintendent of Insurance for the Dominion.

TABLE V.—FIRES REPORTED.

Districts reporting.	Number.	Amount of Loss.
City Municipalities (35).		
Alberni	....	.....
Armstrong	....	.....
Chilliwack	1	$ 800
Courtenay	3	3,474
Cranbrook	7	1,774
Cumberland	5	1,886
Duncan	2	317
Enderby	....	.....
Fernie	6	5,036
Grand Forks	5	2,596
Greenwood	2	930
Kamloops	7	9,910
Kaslo	1	50
Kelowna	7	2,963
Ladysmith	6	2,320
Merritt	7	16,811
Nanaimo	17	1,720
Nelson	10	5,647
New Westminster	28	26,190
North Vancouver	14	2,570
Phoenix	4	4,216
Port Alberni	2	1,050
Port Coquitlam	2	410
Port Moody	8	59,870
Prince George	4	2,729
Prince Rupert	9	5,687
Revelstoke	12	10,321
Rossland	7	2,788
Salmon Arm	1	25
Sandon	2	360
Slocan	1	5
Trail	3	3,993
Vancouver	325	606,123
Vernon	1	2,000
Victoria	110	16,097
Totals	619	$800,668
District Municipalities (28).		
Burnaby	17	$ 107,828
Chilliwhack	8	16,325
Coldstream	....	.....
Coquitlam	1	700
Delta	4	29,800
Esquimalt	8	3,819
Fraser Mills	....	.....
Kent	2	1,968
Langley	2	3,350
Maple Ridge	4	26,010
Matsqui	1	1,200
Mission	5	4,215
North Cowichan	3	4,620
North Vancouver	5	913
Oak Bay	10	194
Peachland	3	2,802
Penticton	6	2,610
Pitt Meadows	1	400
Point Grey	8	78,770
Richmond	86	530,934
Saanich	8	16,525
Salmon Arm	1	2,100
South Vancouver	20	12,052
Spallumcheen	4	2,275
Sumas	1	193
Summerland	3	572
Surrey	3	9,570
West Vancouver	6	3,561
Totals	220	$863,306
Insurance Districts (15).		
Boundary	7	$ 16,696
Fort George	3	16,989
Fort St. John	....	.....
Hazelton	4	3,070
Kamloops	3	3,281
Kootenay, North-east	9	18,191
Kootenay, South-east	10	47,222
Kootenay, West	14	178,966
Lillooet	7	21,396
Nanaimo, West Coast	15	62,707
Carried forward	72	$368,518

TABLE V.—FIRES REPORTED—*Concluded.*

Districts reporting.	Number.	Amount of Loss.
Insurance Districts.—Concluded.		
Brought forward	72	$ 368,518
Prince Rupert	6	7,474
Vancouver-New Westminster	9	28,149
Vernon	....	.....
Victoria	8	11,190
Yale	10	15,921
Totals	105	$ 431,252
Grand totals	944	$2,095,226

NOTE.—Construction of buildings—

Fire-resisting	*Nil,*	loss	*Nil.*
Brick	95	"	$ 191,877
Frame	849	"	1,903,349
Total	944	"	$2,095,226

Average loss *per diem*, $5,740.30.

Loss *per capita*—

The Province, estimated population, 400,000				$5.25
July 5th, 1919, City of Vancouver,	estimated population,	110,000		5.51
" 10th, " City of Victoria,	"	50,000		.32
" 2nd, " City of New Westminster,	"	16,500		1.56
" 7th, " City of Fernie,	"	5,000		1.00
" 8th, " City of Nelson,	"	6,000		.90

TABLE VI.—CAUSES OF FIRES.

Causes of Fires.	Number.	Amount of Loss.
Ashes against wood	17	$ 5,784
Back-fire from oil-burner furnace	1	200
Back-draught from boilers	1	10
Blankets against stove-pipe in attic	1	5
Boys set fire to shingles	1	5
Brick thrown from exploding locomotive	2	125
Broken gas-pipe in carburettor	1	1,000
Candle carelessness	7	224
Carburettor back-firing	10	757
Child placed bath-robe on live ashes	1	4
Children lighting paper at open stove	1	75
Christmas tree caught fire	1	5
Clothes dropped on gas-jet	1	12
Clothes too near stove	6	3,808
Collision of trucks loaded with matches	1	1,779
Curtain caught fire	4	24
Cushion fell against fire-screen	1	15
Defective chimney	39	43,658
Defective fireplace	14	560
Defective furnace	1	11,244
Defective stove or stove-pipes	15	9,047
Defective wiring	15	10,938
Electrical appliances	24	21,826
Elevator-motor	1	25
Exposure	119	545,705
Film ignited by friction	1	49
Fire-crackers	3	200
Fires coming through check-draught in pipe	1	100
Flame from vulcanizer	1	2,800
Friction in feed-pipe	1	11,550
Friction of belt on motor-shaft set grease around motor on fire	1	175
Fumigating carelessness	1	65
Furnace explosion	1	700
Furnace or furnace-pipes insufficiently protected	10	43,091
Gas-burner insufficiently protected	1	373
Gasolene carelessness	4	850
Gasolene-torch ignited tar-paper between joists	1	3
Gasolene-torch exploded	1	452
Grease ignited from fire under grating	1	700
Grease on stove or range	1	379
Heat from grate fire ignited mantelpiece	1	10
Heating-torch blew off, causing coal-oil to spread to hot rivet on top of boiler	1	166
Hot bearing	3	7,985
Carried forward	319	$726,483

TABLE VI.—CAUSES OF FIRES—*Concluded.*

Causes of Fire.	Number.	Amount of Loss.
Brought forward	319	$726,483
Incendiary	10	13,443
Lamp explosion	4	2,562
Lamp upset	9	8,621
Lightning	9	5,185
Lime setting fire to waste paper	1	25
Live coals	4	170
Match carelessness	21	7,487
Matches, children with	19	4,294
Mattress falling on stove	1	3
Molten steel overflowed from open-hearth furnace	1	165
Oil-stove explosion	4	188
Overflow of oil in furnace	1	261,205
Overheated fan-bearing ignited dust	1	1,943
Overheated pipes	1	8,800
Oven insufficiently protected	2	82,800
Paper from stove	1	375
Peat fire	1	10
Rubber tubing ignited	1	1
Short circuit	27	13,534
Smokers' carelessness	42	23,620
Soot from chimney	1	2
Sparks from automobile ignited gasolene on floor	1	50
Sparks from boiler ignited contents of shaving-bin	1	99,350
Sparks from burner	13	42,373
Sparks from burning rubbish	6	265
Sparks from bush fire	11	11,097
Sparks from chimney	190	49,519
Sparks from fireplace	10	251
Sparks from furnace	4	4,078
Sparks from locomotive	2	500
Sparks from retort	1	10
Sparks from stove or stove-pipe	11	10,637
Spark from tempering-tool	1	70
Sparks igniting gas near tar-well	1	337
Spontaneous combustion	11	63,278
Stove or stove-pipe insufficiently protected	37	28,697
Stove explosion	2	2,151
Stove-pipe chimney	3	1,125
Sun's rays shining through spectacles in window	1	12
Tar boiling over on gas-meter or stove	6	3,394
Torch ignited woodwork	1	16
Tramps	3	6,053
Unknown	140	609,834
Wood too close to boiler	1	5
Wood or wood-box too close to stove	3	623
Wood on top of furnace	4	285
Totals	944	$2,095,226

TABLE VII.—CLASSIFICATION OF PROPERTY BURNED AND CAUSES.

Property.		Causes.		Amount of Lose.	
Apartment-houses	19	Ashes against wood	1	$ 2	
		Back-fire from oil-burner furnace	1	200	
		Curtain from stove	1	5	
		Defective chimney	1	25	
		Defective wiring	2	640	
		Electrical appliances	2	669	
		Elevator-motor	1	25	
		Fire coming through check-draught in pipe	1	100	
		Furnace explosion	1	700	
		Match carelessness	1	20	
		Matches, children with	1	132	
		Smokers' carelessness	2	153	
		Spark from chimney	2	20	
		Spark from rubbish	1	10	
		Unknown	1	58	
					$2,759
Automobiles	20	Carburettor back-firing	7	$ 480	
		Exposure	2	3,050	
		Gasolene carelessness	1	10	
		Hot bearing	1	25	
		Match carelessness	3	475	
		Rubber tubing igniting	1	1	
		Short circuit	4	2,050	
		Smokers' carelessness	1	10	
Carried forward	39		39		$ 6,101

TABLE VII.—CLASSIFICATION OF PROPERTY BURNED AND CAUSES—*Continued.*

Property.		Causes.		Amount of Loss.	
Brought forward	39		39		$ 8,860
Bakeries	1	Unknown	1		3,264
Banks	1	Smokers' carelessness	1		53
Barber-shops	2	Exposure	1	150	
		Spark from chimney	1	650	
					800
Barns	10	Incendiary	2	$ 4,755	
		Lightning	1	4,500	
		Matches, children with	2	820	
		Sparks from bush fire	1	1,200	
		Unknown	4	17,160	
					28,435
Bath-houses	1	Smokers' carelessness	1		780
Blacksmith-shops	2	Exposure	2		192
Boats	3	Exposure	1	$ 1,000	
		Unknown	2	9,000	
					10,000
Boat-houses	2	Sparks from chimney	1	$ 10	
		Sparks from stove	1	50	
					60
Boiler-houses	3	Exposure	1	$ 2,308	
		Sparks from furnace	1	2,500	
		Unknown	1	450	
					5,258
Bunk-houses	5	Sparks from chimney	2	$ 1,312	
		Sparks from locomotive	1	350	
		Unknown	2	3,668	
					5,330
Butcher-shops	3	Exposure	3		14,958
Breweries	1	Sparks from chimney	1		418
Canneries	4	Exposure	4		202,705
Chicken-houses	4	Fumigating carelessness	1	$ 65	
		Unknown	3	835	
					900
Churches	3	Gasolene-torch ignited tar-paper between joists	1	$ 3	
		Short circuit	1	84	
		Spark from rubbish	1	50	
					137
Club-houses	3	Exposure	1	$ 6,000	
		Stove insufficiently protected	1	177	
		Unknown	1	2,650	
					8,827
Dog-kennels	1	Unknown	1		22,000
Dry-kilns	5	Overheated pipes	1	$ 8,800	
		Spark from burner	2	64	
		Unknown	2	70,446	
					79,310
Dwellings	541	Ashes against wood	11	$ 946	
		Blankets against stove-pipe in attic	1	5	
		Boys set fire to shingles	1	5	
		Brick thrown from exploding locomotive	2	125	
		Candle carelessness	5	50	
		Child placed bath-robe on live ashes	1	4	
		Children lighting paper at open stove	1	75	
		Christmas tree caught fire	1	5	
		Clothes too near stove	4	3,448	
		Curtain caught fire	2	11	
		Cushion fell against fire-screen	1	15	
		Defective chimney	32	43,313	
		Defective fireplace	13	470	
		Defective stove or stove-pipe	12	7,343	
		Defective wiring	7	3,226	
		Electrical appliances	13	3,179	
		Exposure	54	39,231	
		Fire-crackers	2	75	
		Furnace or furnace-pipes insufficiently protected	4	3,305	
		Incendiary	5	4,947	
		Lamp explosion	4	2,562	
		Lamp upset	6	3,038	
		Lightning	7	493	
		Live coals	3	70	
		Match carelessness	11	5,767	
		Matches, children with	12	3,154	
		Mattress falling on stove	1	3	
		Oil-stove explosion	3	118	
		Peat fire	1	10	
		Short circuit	6	1,090	
Carried forward	634		319	$125,983	$392,287

TABLE VII.—CLASSIFICATION OF PROPERTY BURNED AND CAUSES—*Continued.*

Property.		Causes.		Amount of Loss.	
Brought forward	634		319	$125,983	$392,287
Dwellings—*Concluded*		Smokers' carelessness	11	1,932	
		Soot from chimney	1	2	
		Sparks from burner	2	35	
		Sparks from bush fire	6	5,193	
		Sparks from chimney	159	46,003	
		Sparks from fireplace	10	251	
		Sparks from rubbish	3	200	
		Sparks from stove or stove-pipe	9	10,557	
		Spontaneous combustion	3	2,577	
		Suns rays shining through spectacles in window	1	12	
		Stove explosion	1	2,150	
		Stove or stove-pipe insufficiently protected	31	27,428	
		Stove-pipe chimney	3	1,125	
		Tar boiling over on stove	4	3,055	
		Torch ignited woodwork	1	16	
		Tramps	1	892	
		Unknown	63	108,816	
		Wood or wood-box too close to stove	3	623	
		Wood on top of furnace	3	275	
					337,225
Dyers and cleaners	1	Clothes dropped on gas-jet	1		12
Engine-houses	2	Sparks from bush fire	1	$ 850	
		Sparks from locomotive	1	150	
					1,000
Factories (match)	1	Collision of trucks loaded with matches	1		1,779
Factories (mattress)	1	Match carelessness	1		250
Factories (overall and shirt)	1	Sparks from chimney	1		80
Factories (paper)	1	Furnace insufficiently protected	1		10,781
Factories (pipe)	1	Spontaneous combustion	1		100
Factories (sash and door)	1	Match carelessness	1		190
Factories (soda-water)	2	Sparks from chimney	1	$ 6	
		Unknown	1	780	
					786
Factories (wire and nail)	1	Oven insufficiently protected	1		82,45
Fences	1	Sparks from bush fire	1		7
Fish plants	1	Exposure	1		18,985
Foundries	1	Spark from retort	1		10
Garages	12	Carburettor back-firing	1	$ 2	
		Exposed flame from vulcanizer	1	2,800	
		Gasolene carelessness	2	665	
		Incendiary	1	1,100	
		Smokers' carelessness	1	700	
		Short circuit	2	5,519	
		Spark from automobile ignited gasolene on floor	1	50	
		Spontaneous combustion	1	1,462	
		Unknown	2	4,375	
					16,673
Gas plants	1	Sparks igniting gas near tar-well	1		337
Gasolene-stations	1	Short circuit	1		25
Granaries	1	Incendiary	1		2,141
Halls	1	Defective chimney	1		10
Hospitals	4	Defective wiring	1	$ 560	
		Electrical appliances	1	7	
		Sparks from furnace	1	75	
		Smokers' carelessness	1	115	
					757
Hotels	20	Defective chimney	1	$ 150	
		Defective fireplace	1	90	
		Electrical appliances	2	48	
		Incendiary	1	500	
		Lamp upset	1	12	
		Oil-stove explosion	1	70	
		Smokers' carelessness	7	169	
		Sparks from chimney	1	252	
		Spontaneous combustion	1	10	
		Unknown	4	37,217	
					38,518
House-boats	3	Sparks from burner	3		30
Carried forward	692		692		$904,433

TABLE VII.—CLASSIFICATION OF PROPERTY BURNED AND CAUSES—*Continued.*

Property.		Causes.		Amount of Loss.	
Brought forward	692		692		$904,433
Ice-houses	1	Matches, children with	1		40
Launches	3	Defective wiring	1	60	
		Lamp upset	1	400	
		Spontaneous combustion	1	5	
					465
Laundries	6	Clothes too near stove	1	$ 350	
		Sparks from chimney	1	10	
		Sparks from furnace	1	489	
		Unknown	2	490	
		Wood too close to boiler	1	5	
					1,344
Logs	1	Unknown	1		165
Lumber-mills	4	Unknown	4		81,678
Lumber-yards	2	Sparks from burner	1	$ 30,809	
		Sparks from bush fire	1	2,250	
					33,059
Machine-shops	2	Oven insufficiently protected	1	$ 350	
		Short circuit	1	651	
					1,001
Mess-houses	4	Defective stove-pipe	1	$ 1,425	
		Exposure	2	1,622	
		Unknown	1	2,200	
					5,247
Mining property	4	Furnace insufficiently protected	1	$ 26,475	
		Overheated fan-bearing ignited dust	1	1,943	
		Spontaneous combustion	1	43	
		Tramps	1	3,761	
					32,222
Motor-cycles	1	Carburettor back-firing	1		25
Motor-repair shops	1	Sparks from tempering-tool	1		70
Motor-trucks	4	Broken gas-pipe in carburettor	1	$ 1,000	
		Defective wiring	1	50	
		Carburettor back-firing	1	250	
		Short circuit	1	400	
					1,700
Motors	2	Exposure	1	$ 1,100	
		Unknown	1	500	
					1,600
Net-racks	1	Exposure	1		514
Nurses' home	1	Electrical appliances	1		68
Offices	12	Candle carelessness	1	$ 77	
		Defective chimney	1	100	
		Exposure	1	1,000	
		Furnace or furnace-pipe insufficiently protected	2	420	
		Smokers' carelessness	1	175	
		Sparks from chimney	4	45	
		Unknown	2	1,085	
					2,902
Offices and dwellings	1	Heat from grate fire ignited mantelpiece	1		10
Oil-tanks	1	Friction in feed-pipe	1		11,550
Orphanage	1	Matches, children with	1		46
Planing-mills	1	Back-draught from boilers	1		10
Platforms	1	Matches, children with	1		2
Police-stations	1	Short circuit	1		5
Pool-rooms	2	Exposure	1	$ 5,000	
		Stove insufficiently protected	1	15	
					5,015
Post-offices	1	Exposure	1		100
Power-houses	1	Short circuit	1		42
Printing-offices	3	Defective furnace	1	$ 11,244	
		Hot bearing	1	160	
		Sparks from chimney	1	25	
					11,429
Pump-houses	1	Lightning	1		492
Railway-cars	7	Exposure	3	$ 1,029	
		Short circuit	1	116	
		Smokers' carelessness	1	10	
		Unknown	2	1,462	
					2,617
Carried forward	763		763		$1,097,851

TABLE VII.—CLASSIFICATION OF PROPERTY BURNED AND CAUSES—*Continued.*

Property.		Causes.		Amount of Loss.	
Brought forward	763		763		$1,097,851
Railway-stations	2	Smokers' carelessness	2		310
Restaurants	14	Defective stove-pipe	1	274	
		Exposure	7	11,400	
		Grease on range	1	379	
		Smokers' carelessness	1	150	
		Spark from chimney	2	90	
		Stove insufficiently protected	1	30	
		Unknown	1	2,050	
					14,373
Rooming-houses	10	Ashes against wood	1	$ 55	
		Curtains caught fire	1	8	
		Exposure	1	6,000	
		Smokers' carelessness	2	32	
		Sparks from chimney	4	257	
		Unknown	1	841	
					7,193
Sanatoriums	1	Sparks from stove	1		30
Sawmills	11	Defective wiring	1	$ 6,000	
		Sparks from boiler ignited contents of shaving-bin	1	99,350	
		Sparks from burner	1	943	
		Sparks from furnace	1	5	
		Spontaneous combustion	1	7,256	
		Tar boiling over	1	10	
		Unknown	5	88,429	
					201,993
Schools	4	Sparks from chimney	2	$ 160	
		Stove-pipes insufficiently protected	1	727	
		Unknown	1	2,000	
					2,887
Sheds	11	Ashes against wood	2	$ 60	
		Short circuit	1	1,100	
		Smokers' carelessness	3	860	
		Sparks from burner	1	3	
		Sparks from chimney	1	5	
		Unknown	3	500	
					2,528
Shingle-mills	4	Hot bearing	1	$ 7,800	
		Unknown	3	62,350	
					70,150
Shipyards	3	Heating-torch blew off, causing coal-oil to spread to hot rivet on top of boiler	1	$ 166	
		Overflow of oil in furnace	1	261,205	
		Unknown	1	152	
					261,523
Slaughter-houses	1	Spark from furnace	1		2,100
Smoke-houses	1	Grease ignited from fire under grating	1		700
Stables	10	Matches, children with	1	$ 100	
		Unknown	9	17,694	
					17,794
Steel plants	1	Molten steel overflowed from open-hearth furnace	1		165
Stores	45	Ashes against wood	1	$ 2,213	
		Candle carelessness	1	97	
		Defective wiring	1	400	
		Electrical appliances	2	17,849	
		Exposure	14	19,036	
		Fire-crackers	1	125	
		Friction of belt on motor-shaft set grease around motor on fire	1	175	
		Furnace-pipe insufficiently protected	1	10	
		Gas-burner insufficiently protected	1	373	
		Lamp upset	1	5,171	
		Match carelessness	2	43	
		Smokers' carelessness	4	435	
		Sparks from chimney	2	45	
		Sparks from furnace	1	1,898	
		Spontaneous combustion	1	1,825	
		Stove insufficiently protected	2	315	
		Unknown	9	56,487	
					106,497
Stores and dwellings, over	17	Clothes too near stove	1	$ 10	
		Electrical appliances	1	3	
		Exposure	10	53,669	
		Spark from chimney	1	20	
		Unknown	3	5,233	
		Wood on top of furnace	1	10	
					58,945
Stores and halls, over	2	Ashes against wood	1	$ 2,508	
		Exposure	1	224	
					2,732
Carried forward	900		900		1,847,771

TABLE VII.—CLASSIFICATION OF PROPERTY BURNED AND CAUSES—*Concluded.*

Property.		Causes.		Amount of Loss.	
Brought forward	900		900		$1,847,771
Stores and offices, over	5	Gasolene carelessness	1	175	
		Papers from stove	1	375	
		Short circuit	2	1,702	
		Smokers' carelessness	1	2,700	
					4,952
Stores and rooms, over	12	Defective chimney	3	$ 60	
		Electrical appliances	1	3	
		Exposure	1	22	
		Furnace insufficiently protected	1	2,100	
		Match carelessness	1	114	
		Short circuit	1	25	
		Smokers' carelessness	1	36	
		Sparks from chimney	1	8	
		Stove insufficiently protected	1	10	
		Unknown	1	3	
					2,381
Street-cars	1	Short circuit	1		25
Tents	1	Stove explosion	1		1
Theatres (moving-picture)	2	Film ignited by friction	1	$ 49	
		Match carelessness	1	628	
					677
Theatres	2	Exposure	1	$ 375	
		Smokers' carelessness	1	15,000	
					15,375
Tin-shops	1	Tar boiling over on gas-meter	1		329
Transformers	2	Short circuit	1	$ 100	
		Unknown	1	400	
					500
Warehouses	13	Exposure	4	$155,535	
		Lime setting fire to waste paper	1	25	
		Live coals	1	100	
		Short circuit	1	100	
		Sparks from bush fire	1	1,597	
		Sparks from chimney	2	603	
		Tramps	1	1,400	
		Unknown	2	55,396	
					214,756
Wharves	2	Short circuit	1	$ 500	
		Sparks from burner	1	7,500	
					8,000
Wood-piles	1	Sparks from burning rubbish	1		5
Workshops	2	Defective wiring	1	$ 2	
		Gasolene torch exploded	1	452	
					454
Totals	944		944		$2,095,226

TABLE VIII.—SUMMARY.

	Fires reported.				Amount of Loss.			
	Cities (35).	Other Municipalities (28).	Insurance Districts (15).	Total.	Cities (35).	Other Municipalities (28).	Insurance Districts (15).	Total.
1918.								
January	26	9	3	38	$ 25,275	$ 7,115	$ 4,050	$ 36,440
February	45	5	5	55	18,987	1,025	4,936	24,948
March	41	10	5	56	25,724	13,067	2,236	41,027
April	72	19	8	99	32,534	49,052	22,673	104,259
May	82	101	11	194	308,767	615,286	12,161	936,214
June	76	9	17	102	71,478	23,606	76,333	171,417
July	69	7	18	94	103,654	89,525	34,826	228,005
August	44	9	5	58	30,200	12,243	7,690	50,133
September	49	16	15	80	21,059	15,456	70,121	106,636
October	28	11	5	44	44,685	9,781	136,682	191,148
November	43	11	5	59	21,866	11,789	13,309	46,964
December	44	13	8	65	96,439	15,361	46,235	158,035
Totals, 1918	619	220	105	944	$ 800,668	$ 863,306	$431,252	$2,095,226
Totals, 1917	422	123	117	662	756,427	227,442	558,009	1,541,878
Totals, 1916	496	172	...	668	1,041,440	339,512	.....	1,380,952
Totals, 1915	469	240	...	709	865,093	365,717	.....	1,230,810
Totals, 1914	535	223	...	758	1,249,723	390,111	.....	1,639,834
Grand totals	2,541	978	222	3,741	$4,713,351	$2,186,088	$989,261	$7,888,700

TABLE IX.—LOSS OF LIFE, 1916-18.

Occupancy.	Cause of Fire.	Loss of Life.	
		Adults.	Children.
Dwelling	Lamp explosion	1	....
Dwelling	Unknown	1	....
Garage	Exposed flame from vulcanizer	1	....
Shipyard	Overflow of oil in furnace	1	....
Total		4	....
Totals, 1917		8	1
Totals, 1916		6	9

TABLE X.—INVESTMENTS IN BRITISH COLUMBIA OF COMPANIES OTHER THAN LIFE INSURANCE COMPANIES.

(For British Columbia investments of Life Insurance Companies *see* Abstract of Returns of Life Insurance Companies, *post.*)

Name of Company.	Mortgages.	In other Securities.
American Central Insurance Co	.....	$ 30,660 00*
Boiler Inspection & Insurance Co. of Canada	.....	44,000 00*
Boston Insurance Co	.....	25,000 00
British America Assurance Co	.....	160,866 66
British Columbia Plate Glass Insurance Co	.....	5,973 33
British Colonial Fire Insurance Co	.....	3,000 00
British Crown Assurance Corporation, Ltd	.....	23,219 86
Caledonian Insurance Co., Ltd	$1,193,932 00	69,164 00
California Insurance Co	.....	25,000 00*
Canada Accident Assurance Co	.....	19,000 00
Canada National Fire Insurance Co	78,633 33	.....
Canadian Surety Co	.....	25,733 33*
Century Insurance Co., Ltd	.....	26,000 00†
Commercial Union Assurance Co., Ltd	391,035 12	.....
Dominion Fire Insurance Co	14,000 00	33,460 64†
Dominion of Canada Guarantee & Accident Insurance Co	.....	93,911 50*
General Accident Assurance Co. of Canada	.....	33,332 64*
General Accident Fire & Life Assurance Corporation, Ltd	.....	45,779 47*
Glens Falls Insurance Co	.....	20,000 00
Globe & Rutgers Fire Insurance Co	.....	48,180 00
Globe Indemnity Co. of Canada	.....	5,000 00
Guardian Assurance Co., Ltd	.....	56,590 00‡
Guardian Insurance Co. of Canada	.....	39,767 36†
Hartford Fire Insurance Co	.....	76,000 00*
Home Insurance Co	.....	50,000 00*
Hudson Bay Insurance Co	37,233 96	102,779 49
Imperial Guarantee & Accident Insurance Co	.....	29,676 50‡
Imperial Underwriters Corporation of Canada	103,558 00	30,434 75‡
Insurance Co. of the State of Pennsylvania	.....	53,200 00*
Law Union & Rock Insurance Co., Ltd	380,000 00	.....
Liverpool-Manitoba Assurance Co	.....	30,000 00*
London & Lancashire Guarantee & Accident Insurance Co	.....	447 80‡
London Assurance Corporation	48,500 00	176,000 00
London Guarantee & Accident Co., Ltd	.....	356,107 44
London Mutual Fire Insurance Co. of Canada	546 70	25,975 00
Loyal Protective Insurance Company	.....	9,400 00†
Maryland Casualty Company	.....	61,684 26†
National Ben Franklin Fire Insurance Co	.....	39,997 12‡
National Benefit Assurance Co., Ltd	.....	32,739 66†
National Fire Insurance Co. of Hartford	.....	22,984 75
National Union Fire Insurance Co	.....	35,000 00*
North American Accident Insurance Co	.....	15,437 00‡
North British & Mercantile Insurance Co	424,000 00	148,600 00*
North Empire Fire Insurance Co	.....	45,000 00‡
Northern Assurance Co., Ltd	.....	250,000 00
Northwestern National Insurance Co	.....	52,827 05‡
Norwich Union Fire Insurance Society, Ltd	.....	75,200 00*
Pacific Coast Fire Insurance Co	237,709 90	511,367 49‡
Phoenix Insurance Co	.....	18,400 00
Queen Insurance Co. of America	.....	32,000 00*
Royal Insurance Co., Ltd	290,000 00	214,850 67*
Royal Plate Glass Insurance Co. of Canada	2,250 00	.....
Springfield Fire & Marine Insurance Co	.....	35,100 00†
Union Marine Insurance Co., Ltd	.....	22,212 92
Totals	$3,201,399 01	$3,387,060 69

* Par value. † Market value. ‡ Book value.

TABLE XI.—ABSTRACT OF THE RETURNS OF LIFE INSURANCE COMPANIES TRANSACTING BUSINESS IN THE PROVINCE OF BRITISH COLUMBIA, 1918.

Name of Company.	Premiums for the Year.	Number of Policies, new and taken up.	Amount of Policies, new and taken up.	Number of Policies in Force at Date.	Net Amount in Force.	Number of Policies become Claims.	Net Amount of Policies become Claims.	Claims paid including Matured Endowments.	Unsettled Claims.		Amount invested in British Columbia.	
									Not resisted.	Resisted.	On Mortgages.	On other Securities.
1. Canada Life Assurance Co.	$ 222,192 54	490	$1,049,296 00	2,710	$6,557,892 00	43	$ 97,162 00	$ 73,325 00	$ 43,937 00	*Nil.*	$ 574,468 98	* $1,399,692 58
2. Capital Life Assurance Co. of Canada	1,657 15	.....	*Nil.*	17	40,000 00	*Nil.*	*Nil.*	*Nil.*	*Nil.*	*Nil.*	*Nil.*	* 39,332 89
3. Confederation Life Association	192,318 85	693	1,344,150 00	3,261	6,074,531 00	.....	97,896 00	74,775 00	41,160 00	.....	1,299,161 18	* 405,296 55
4. Continental Life Insurance Co.	31,695 25	65	95,700 00	585	963,337 00	7	12,500 00	6,500 00	6,000 00	.....	3,000 00	* 105,243 97
5. Crown Life Insurance Co.	80,817 43	.....	446,500 00	.....	2,868,405 00	.....	27,559 89	20,601 24	11,000 00	*Nil.*	35,100 00	† 85,035 43
6. Dominion Life Assurance Co.	20,770 15	210	389,440 00	417	744,940 00	5	6,650 00	5,500 00	1,150 00	*Nil.*	.....	.....
7. Equitable Life Assurance Society of U.S.	73,843 35	74	162,000 00	1,054	2,306,213 00	24	47,566 90	56,643 90	9,000 00	*Nil.*	375,000 00	* 329,690 00
8. Excelsior Life Insurance Co.	56,700 00	.....	674,180 00	.....	1,573,437 00	9	11,804 00	5,944 00	7,249 20	*Nil.*	*Nil.*	‡ 4,455 00
9. Great West Life Assurance Co.	440,797 34	.....	2,635,418 00	.....	13,257,301 00	.....	177,036 20	141,158 35	81,896 00	$10,000	453,889 55	.....
10. Gresham Life Assurance Society	4,979 14	*Nil.*	*Nil.*	60	102,675 67	1	1,000 00	*Nil.*	1,000 00	*Nil.*	*Nil.*	*Nil.*
11. Imperial Life Assurance Co.	159,745 38	520	991,970 00	2,320	4,571,416 00	.....	94,090 20	77,607 80	26,546 60	*Nil.*	115,612 20	† 310,163 63
12. London Life Insurance Co.	36,317 20	444	626,000 00	778	1,078,850 00	7	9,000 00	7,000 00	2,000 00	*Nil.*	*Nil.*	† 262,728 84
13. London & Lancashire Life & General Assurance Association, Ltd.	35,418 10	54	128,291 00	.....	1,180,570 00	17	25,595 91	15,920 91	10,175 00	.....	*Nil.*	* 134,504 00
14. Manufacturers Life Insurance Co.	75,720 09	230	409,921 00	985	1,774,774 00	16	20,753 75	25,582 75	6,171 00	*Nil.*	1,714 65	† 458,150 20
15. Metropolitan Life Insurance Co. { Ordinary	189,749 77	2,216	1,970,000 00	7,314	6,260,000 00	105	67,661 05	64,034 05	109 00	10,518	.....	.....
{ Industrial	206,444 51	12,101	1,590,000 00	44,494	5,530,000 00	383	49,554 82	49,572 82	.....	1,083	3,700 00	† 1,086,996 08
16. Monarch Life Assurance Co.	117,984 70	.....	1,235,500 00	.....	4,183,960 00	.....	37,439 13	9,000 00	28,439 13	.....	11,130 60	* 24,971 13
17. Mutual Life Assurance Co. of Canada	324,886 15	731	1,282,388 00	4,904	9,110,684 00	81	136,441 00	112,244 00	57,597 00	*Nil.*	538,705 33	* 489,238 08
18. Mutual Life Insurance Co. of N.Y.	91,689 23	79	149,713 25	1,605	3,206,348 00	36	94,331 75	71,675 75	22,656 00	*Nil.*	*Nil.*	*Nil.*
19. National Life Assurance Co. of Canada	50,612 37	.....	166,987 00	.....	1,173,771 00	12	41,000 00	55,000 00	1,000 00	*Nil.*	*Nil.*	*Nil.*
20. New York Life Insurance Co.	362,601 18	770	1,458,104 00	4,873	10,113,455 00	113	224,533 84	278,931 85	80,150 00	*Nil.*	1,040,500 00	* 100,000 00
21. North American Life Assurance Co.	196,360 87	506	1,123,732 00	2,915	5,611,090 00	.....	58,517 45	39,751 30	29,266 15	*Nil.*	538,364 96	* 880,459 92
22. Northern Life Assurance Co. of Canada	17,714 81	.....	167,000 00	210	431,550 00	3	4,000 00	5,202 00	*Nil.*	*Nil.*	5,000 00	† 91,712 41
23. Norwich Union Life Insurance Society	375 61	.....	.....	.....	7,154 00	.....	.....	.....	.....	.....	117,500 00	* 33,846 67
24. Phoenix Assurance Co., Ltd.	8,412 20	14	1,132 26	160	437,175 00	1	3,000 00	4,002 50	*Nil.*	*Nil.*	38,500 00	†§ 13,498 74
25. Prudential Insurance Co. of America { Ordinary	98,059 81	1,136	1,334,705 00	3,425	3,775,424 00	44	47,341 11	41,700 11	9,551 00	*Nil.*	*Nil.*	§ 23,263 77
{ Industrial	142,348 99	7,549	1,321,754 00	25,937	4,055,789 00	249	59,738 25	60,162 16	2,448 84	*Nil.*	*Nil.*	¶ 315,972 35
26. Royal Insurance Co., Ltd.	70,262 35	54	202,464 00	838	2,343,937 67	12	19,585 00	6,240 00	17,405 00	.....	*Nil.*	§ 31,691 87
27. Sovereign Life Assurance Co. of Canada	33,008 60	136	295,404 00	410	847,839 00	2	4,000 00	2,000 00	2,000 00	*Nil.*	*Nil.*	† 35,500 00
28. Standard Life Assurance Co. of Canada**	29,344 43	25	41,660 00	390	935,912 23	12	17,518 65	26,708 98	7,547 89	50,000	305,000 00	‖ 115,991 55
29. Sun Life Assurance Co. of Canada	395,074 96	712	1,074,591 76	5,441	10,016,232 48	.....	242,453 60	194,821 59	95,992 73	.....	1,357,477 30	† 1,899,037 66
30. Travelers Insurance Co.	16,707 66	54	236,061 00	175	634,150 00	3	12,160 00	12,160 00	*Nil.*	*Nil.*	*Nil.*	¶ 514,905 27
31. Travellers Life Assurance Co. of Canada	2,690 73	3	13,000 00	40	98,180 00	2	2,500 00	2,500 00	*Nil.*	*Nil.*	*Nil.*	* 10,000 00
32. Union Mutual Life Insurance Co.	16,101 01	5	5,500 00	282	510,000 00	11	15,212 99	10,217 95	7,000 00	*Nil.*	*Nil.*	129,966 67
33. Western Empire Life Insurance Co.	3,412 67	93	170,000 00	75	128,000 00	.....	*Nil.*	*Nil.*	*Nil.*	*Nil.*	13,000 00	‡ 15,125 35
34. Western Life Assurance Co.	16,643 53	.....	188,850 00	.....	473,925 00	.....	7,000 00	2,000 00	5,000 00	*Nil.*	*Nil.*	5,859 25
	$3,823,458 11	.....	$22,981,412 27	.....	112,978,918 05	.....	$1,772,603 49	$1,558,574 01	$613,447 54	$71,601	$6,826,824 75	$9,352,329 86

* Basis of valuationnot stated. † Book value. ‡ Market value. § Including loans on policies. ‖ Par value. ¶ Cost value. ** Year ended November 15th, 1918.

TABLE XII.—LIFE INSURANCE SUMMARY.

	1914.	1915.	1916.	1917.	1918.
Premiums for year	$ 2,817,000	$ 2,761,000	$ 2,906,000	$ 3,313,000	$ 4,026,000
Net amount in force	84,149,000	83,204,000	87,983,000	95,309,000	112,978,000
Claims paid	678,000	1,021,000	1,034,000	1,302,000	1,558,000

TABLE XIV.—MISCELLANEOUS INSURANCE SUMMARY.

	1914.	1915.	1916.	1917.	1918.
Accident, P.	$157,000	$139,000	$126,000	$197,000	$221,000
„ L.	71,000	62,000	47,000	111,000	78,000
Sickness, P.	68,000	68,000	100,000	50,000	73,000
„ L.	20,000	32,000	43,000	21,000	41,000
Liability, P.	559,000	279,000	282,000	68,000	31,000
„ L.	244,000	155,000	191,000	103,000	14,000
Automobile, P.	102,000	57,000	93,000	135,000	230,000
„ L.	44,000	33,000	28,000	50,000	65,000
Marine, P.	.....	130,000	200,000	283,000	404,000
„ L.	.....	68,000	120,000	152,000	125,000
Other forms, P.	112,600	73,000	69,000	74,000	79,000
„ L.	63,000	26,000	28,000	22,000	21,000

P.—Premiums. L.—Losses.

Marine.		Live Stock, Steam-boiler, Sprinkler Leakage, Inland Transportation, Fly-wheel and Explosion. (Indicated by Initial letters.)		Total Premiums.	Total Losses.	Unsettled Claims.	
Premiums.	Losses.	Premiums.	Losses.				
$ 46,493 35	$ 13,704 77	.....	.....	$ 47,983 70	$ 13,729 77	$ 2,963 42	1
6,789 11	154 54	.....	.....	9,547 34	1,267 65	*Nil.*	2
.....	.....	S.B. $1,025 95	*Nil.*	1,025 95	*Nil.*	*Nil.*	3
24,670 91	13,847 94	.....	.....	24,670 91	13,847 94	*Nil.*	4
25,829 00	*Nil.*	.....	.....	25,829 00	*Nil.*	*Nil.*	5
.....	.....	.....	.....	2,067 45	*Nil.*	50 00	6
.....	.....	.....	.....	12,273 28	7,021 78	*Nil.*	7
.....	.....	.....	.....	6,857 22	2,824 82	979 65	8
6,952 96	*Nil.*	.....	.....	6,952 96	*Nil.*	.....	9
.....	.....	.....	.....	11,221 10	2,016 11	800 00	10
.....	.....	.....	.....	4,599 73	94 24	125 00	11
37,635 01	13,591 51	.....	.....	37,635 01	13,591 51	900 00	12
.....	.....	.....	.....	57,162 43	28,204 43	4,977 52	13
.....	.....	.....	.....	67,011 11	15,451 35	*Nil.*	14
.....	.....	.....	.....	10,851 70	5,703 05	560 99	15
25,390 25	15,402 30	.....	.....	25,390 25	15,402 30	2,903 00	16
.....	.....	.....	.....	19,318 59	21,268 39	4,565 00	17
.....	.....	.....	.....	122 18	16 59	*Nil.*	18
.....	.....	S.B. 335 05 F.W. 343 00	*Nil.* *Nil.*	5,266 82	669 96	*Nil.*	19
37,451 82	9,641 69	.....	.....	41,862 61	10,085 24	2,025 55	20
.....	.....	S.B. 231 32	*Nil.*	20,710 57	3,750 37	12,559 10	21
.....	.....	L.S. 530 45	*Nil.*	530 45	*Nil.*	240 00	22
.....	.....	.....	.....	42,149 91	16,520 58	16,311 08	23
7,669 98	*Nil.*	.....	.....	11,134 49	362 34	614 00	24
.....	.....	L.S. 32 00	*Nil.*	32 00	*Nil.*	*Nil.*	25
.....	.....	.....	.....	8,015 56	*Nil.*	*Nil.*	26
.....	.....	.....	.....	3,560 14	1,273 02	4,865 91	27
.....	.....	E. 713 75	*Nil.*	3,217 92	626 11	*Nil.*	28
.....	.....	.....	.....	17,373 77	7,907 22	13,214 37	29
29,024 26	12,899 62	I.T. 77 50	$ 2 50	43,002 67	16,773 25	1,177 00	30
.....	.....	.....	.....	4,140 76	292 79	360 00	31
.....	.....	.....	.....	3,105 24	933 98	112 88	32
5,995 70	497 39	.....	.....	5,995 70	497 39	*Nil.*	33
.....	.....	.....	.....	34,581 05	10,249 20	31,290 00	34
.....	.....	.....	.....	26,583 42	6,890 55	401 00	35
3,823 61	1,002 00	.....	.....	3,823 61	1,002 00	*Nil.*	36
.....	.....	.....	.....	3,439 75	2,333 61	600 00	37
.....	.....	.....	.....	6,585 03	2,141 09	574 46	38
233 94	*Nil.*	.....	.....	233 94	*Nil.*	*Nil.*	39
.....	.....	.....	.....	446 75	303 33	748 33	40
.....	.....	S.L. 378 10	.....	6,302 98	488 43	1,011 00	41
.....	.....	.....	.....	33,461 71	13,268 24	4,124 60	42
.....	.....	.....	.....	1,422 03	1,056 35	*Nil.*	43
.....	.....	.....	.....	1,895 05	5,033 80	5,327 30	44
.....	.....	.....	.....	3,362 31	1,054 95	352 59	45
.....	.....	.....	.....	2,887 74	690 56	125 00	46
.....	.....	.....	.....	8,876 44	5,187 66	170 00	47
.....	.....	.....	.....	2,919 54	50 95	*Nil.*	48
.....	.....	.....	.....	19,431 40	2,465 31	951 50	49
.....	.....	.....	.....	27,574 05	12,034 47	3,915 00	50
2,605 31	2,009 35	.....	.....	2,605 31	2,009 35	*Nil.*	51
4,342 94	2,714 34	.....	.....	26,956 18	12,825 85	3,111 00	52
.....	.....	.....	.....	8,907 30	5,590 69	*Nil.*	53
.....	.....	.....	.....	4,817 73	338 96	150 00	54
3,530 26	*Nil.*	.....	.....	3,530 26	*Nil.*	1,434 27	55
.....	.....	.....	.....	33,519 90	7,683 21	4,945 00	56
.....	.....	.....	.....	1,614 50	743 65	818 65	57
1,579 84	371 68	.....	.....	1,579 84	371 68	*Nil.*	58
.....	.....	.....	.....	9,403 11	2,010 76	678 62	59
.....	.....	.....	.....	2,817 43	1,455 26	*Nil.*	60
24,925 79	*Nil.*	I.T. 24 25	*Nil.*	29,503 64	1,223 49	34 15	61
.....	.....	S.L. 87 50	*Nil.*	4,685 36	1,035 20	634 00	62
29,001 14	23,433 60	.....	.....	29,001 14	23,433 60	.....	63
8,144 56	*Nil.*	.....	.....	8,144 56	*Nil.*	3,840 00	64
.....	.....	.....	.....	3,209 03	1,638 57	*Nil.*	65
.....	.....	.....	.....	5,803 69	259 39	*Nil.*	66
37,598 26	10,102 97	.....	.....	39,744 42	11,285 72	*Nil.*	67
2,241 70	73 67	.....	.....	9,821 75	2,412 06	1,400 00	68
.....	.....	.....	.....	15,167 64	2,230 93	8,532 00	69
10,657 67	9,179 91	I.T. 787 01	248 85	12,942 03	9,428 76	2,500 00	70
11,252 64	4,936 15	.....	.....	11,252 64	4,936 15	146 58	71
11,834 49	2,403 86	.....	.....	11,834 49	2,403 86	1,760 50	72
.....	.....	L.S. 175 05	*Nil.*	768 30	95 75	75 00	73
$405,674 50	$135,967 29	$ 4,740 93	$ 251 35	$1,041,975 57	$357,795 57	$149,955 02	

TABLE XIII.—MISCELLANEOUS BUSINESS: NET PREMIUMS AND LOSSES, 1918.

NAME OF COMPANY.	ACCIDENT.		SICKNESS.		LIABILITY.		AUTOMOBILE.		BURGLARY.		GUARANTEE.		PLATE GLASS.		MARINE.		LIVE STOCK, STEAM-BOILER, SPRINKLER LEAKAGE, INLAND TRANSPORTATION, FLY-WHEEL AND EXPLOSION. (Indicated by Initial letters.)		Total Premiums.	Total Losses.	Unsettled Claims.	
	Premiums.	Losses.	Premiums.	Losses.	Premiums.	Losses.	Premiums.	Losses.	Premiums.	Losses.	Premiums.	Losses.	Premiums.	Losses.	Premiums.	Losses.	Premiums.	Losses.				
1. Aetna Insurance Co.							$ 1,490 35	$ 25 00							$ 46,493 35	$ 13,704 77			$ 47,983 70	$ 13,729 77	$ 2,963 42	1
2. Alliance Assurance Co.	$ 191 25	*Nil.*	$ 72 50	$ 20 00			2,294 48	1,093 11			$ 200 00	*Nil.*			6,789 11	154 54			9,547 34	1,267 65	*Nil.*	2
3. Boiler Inspection & Insurance Co. of Canada †																	S.B. $1,025 95	*Nil.*	1,025 95	*Nil.*	*Nil.*	3
4. Boston Insurance Co.															24,670 91	13,847 94			24,670 91	13,847 94	*Nil.*	4
5. British & Foreign Marine Insurance Co.															25,829 00	*Nil.*			25,829 00	*Nil.*	*Nil.*	5
6. British America Assurance Co.							2,067 45	*Nil.*											2,067 45	*Nil.*	50 00	6
7. British Columbia Plate Glass Insurance Co.													$ 12,273 28	$ 7,021 78					12,273 28	7,021 78	*Nil.*	7
8. British Crown Assurance Corporation							6,857 22	2,824 82											6,857 22	2,824 82	979 65	8
9. British Traders Insurance Co.															6,952 96	*Nil.*			6,952 96	*Nil.*		9
10. Canada Accident Assurance	3,483 44	$ 754 82	1,796 12	900 31			4,967 57	130 01	$ 98 08	*Nil.*	181 92	*Nil.*	693 97	230 97					11,221 10	2,016 11	800 00	10
11. Canadian Surety Co.							247 21	94 24	30 00	*Nil.*	4,322 52	*Nil.*							4,599 73	94 24	125 00	11
12. Canton Insurance Office, Ltd.															37,635 01	13,591 51			37,635 01	13,591 51	900 00	12
13. Continental Casualty Co.	35,320 01	13,858 43	18,091 57	12,277 05			3,750 85	2,068 95											57,162 43	28,204 43	4,977 52	13
14. Dominion of Canada Guarantee & Accident Insurance Co.	29,496 49	5,924 15	13,932 20	5,497 97			20,541 72	3,660 87	68 75	*Nil.*	1,780 76	*Nil.*	1,191 19	368 36					67,011 11	15,451 35	*Nil.*	14
15. Dominion Gresham Guarantee & Casualty Co.	4,068 15	299 99	2,358 95	1,230 39	$ 274 00	*Nil.*	3,647 70	4,172 67	300 03	*Nil.*	202 87	*Nil.*							10,851 70	5,703 05	560 99	15
16. Eagle Star & British Dominions Insurance Co., Ltd.															25,390 25	15,402 30			25,390 25	15,402 30	2,903 00	16
17. Employers Liability Assurance Corporation	4,949 23	10,220 29	2,102 82	968 21	2,120 46	$ 6,618 12	8,081 52	1,461 77			2,064 56	$ 2,000 00							19,318 59	21,268 39	4,565 00	17
18. Equitable Fire & Marine Insurance Co.							122 18	16 59											122 18	16 59	*Nil.*	18
19. Fidelity & Casualty Co.	590 49	*Nil.*	395 73	147 66	1,003 66	*Nil.*	982 62	8 25	1,115 93	*Nil.*			500 34	514 05			{ S.B. 335 05 / F.W. 343 00	*Nil.* / *Nil.*	5,266 82	669 96	*Nil.*	19
20. Fireman's Fund Insurance Co.							4,410 79	443 55							37,451 82	9,641 69			41,862 61	10,085 24	2,025 55	20
21. General Accident Assurance Co. of Canada	*5,293 03	928 51			8,245 35	1,910 18	6,362 79	911 68			578 08	*Nil.*					S.B. 231 32	*Nil.*	20,710 57	3,750 37	12,559 10	21
22. General Animals Insurance Co. of Canada																	L.S. 530 45	*Nil.*	530 45	*Nil.*	240 00	22
23. Globe Indemnity Co. of Canada	18,841 34	4,261 01	12,866 26	10,181 03	826 72	28 05	9,149 42	2,050 49	93 00		373 17								42,149 91	16,520 58	16,311 08	23
24. Great American Insurance Co.							3,464 51	362 34							7,669 98	*Nil.*			11,134 49	362 34	614 00	24
25. Great North Insurance Co.																	L.S. 32 00	*Nil.*	32 00	*Nil.*	*Nil.*	25
26. Guarantee Co. of North America											8,015 56	*Nil.*							8,015 56	*Nil.*	*Nil.*	26
27. Guardian Insurance Co. of Canada	*1,628 24	514 12			444 97	276 75	1,340 18	276 75	16 25	*Nil.*	54 25	*Nil.*	76 25	205 40					3,560 14	1,273 02	4,865 91	27
28. Home Insurance Co.							2,504 17	626 11									E. 713 75	*Nil.*	3,217 92	626 11	*Nil.*	28
29. Imperial Guarantee & Accident Insurance Co.	6,479 65	1,888 17	3,045 15	2,456 44			6,890 93	3,510 81			779 93	20 60	178 11	31 20					17,373 77	7,907 22	13,214 37	29
30. Insurance Co. of North America							13,900 91	3,871 13							29,024 26	12,899 62	I.T. 77 50	$ 2 50	43,002 67	16,773 25	1,177 00	30
31. Law Union & Rock Insurance Co., Ltd.	802 43	37 50	573 17	149 64	2,765 16	105 65													4,140 76	292 79	360 00	31
32. Lloyds Plate Glass Insurance Co.													3,105 24	933 98					3,105 24	933 98	112 88	32
33. London Assurance Corporation															5,995 70	497 39			5,995 70	497 39	*Nil.*	33
34. London Guarantee & Accident Co., Ltd	10,220 34	1,166 24	966 31	592 14	4,078 90	3,717 56	14,732 98	4,773 26			4,582 52								34,581 05	10,249 20	31,290 00	34
35. London & Lancashire Guarantee & Accident Co.	4,155 59	721 73	1,970 12	438 17	930 03	13 20	14,424 08	4,664 74			2,874 47	*Nil.*	2,229 13	1,052 71					26,583 42	6,890 55	401 00	35
36. London & Provincial Marine & General Insurance Co., Ltd.															3,823 61	1,002 00			3,823 61	1,002 00	*Nil.*	36
37. Loyal Protective Insurance Co.	3,439 75	2,333 61																	3,439 75	2,333 61	600 00	37
38. Marine Insurance Co., Ltd.							6,585 03	2,141 09											6,585 03	2,141 09	574 46	38
39. Maritime Insurance Co., Ltd.															233 94	*Nil.*			233 94	*Nil.*	*Nil.*	39
40. Maryland Assurance Corporation, Ltd.	218 44		228 31	303 33															446 75	303 33	748 33	40
41. Maryland Casualty Co.	143 81	249 99	125 19		1,604 00		2,192 54	65 00	604 76		635 34	−293 93	619 24	467 37			S.L. 378 10		6,302 98	488 43	1,011 00	41
42. Merchants Casualty Co.	*33,461 71	13,268 24																	33,461 71	13,268 24	4,124 60	42
43. National Provincial Plate Glass & General Insurance Co., Ltd.													1,422 03	1,056 35					1,422 03	1,056 35	*Nil.*	43
44. National Surety Co.											1,895 05	5,033 80							1,895 05	5,033 80	5,327 30	44
45. New York Plate Glass Insurance Co.													3,362 31	1,054 95					3,362 31	1,054 95	352 59	45
46. Niagara Fire Insurance Co.							2,887 74	690 56											2,887 74	690 56	125 00	46
47. North American Accident Insurance Co.	3,858 96	603 64	417 43	278 20	128 54	1,001 50	3,926 00	2,999 20					545 51	305 12					8,876 44	5,187 66	170 00	47
48. Northwestern National Insurance Co.							2,919 54	50 95											2,919 54	50 95	*Nil.*	48
49. Norwich Union Fire Insurance Society	8,893 68	464 73	5,591 78	814 86	608 10	10 00	3,563 85	933 52					778 99	242 20					19,431 40	2,465 31	951 50	49
50. Ocean Accident & Guarantee Corporation, Ltd.	*13,936 79	9,292 45			1,971 00	583 15	9,058 85	1,439 50	64 40		244 30	*Nil.*	2,298 71	719 37					27,574 05	12,034 47	3,915 00	50
51. Ocean Marine Insurance Co., Ltd.															2,605 31	2,009 35			2,605 31	2,009 35	*Nil.*	51
52. Phœnix Insurance Co.							22,613 24	10,111 51							4,342 94	2,714 34			26,956 18	12,825 85	3,111 00	52
53. Protective Association of Canada	*8,907 30	5,590 69																	8,907 30	5,590 69	*Nil.*	53
54. Queen Insurance Co. of America							4,817 73	338 96											4,817 73	338 96	150 00	54
55. Queensland Insurance Co., Ltd.															3,530 26	*Nil.*			3,530 26	*Nil.*	1,434 27	55
56. Railway Passengers Assurance Co	13,034 58	4,074 96	5,687 90	2,759 19	2,365 60	73 50	11,019 53	2,878 67	53 84	*Nil.*	708 99	−2,687 29	649 46	584 18					33,519 80	7,668 21	4,945 00	56
57. Ridgely Protective Association	*1,614 50	743 65																	1,614 50	743 65	818 65	57
58. Reliance Marine Insurance Co.															1,579 84	371 68			1,579 84	371 68	*Nil.*	58
59. Royal Exchange Assurance	817 50	999 09	506 50	446 45	1,352 65		6,726 46	565 22											9,403 11	2,010 76	678 62	59
60. Royal Plate Glass Insurance Co.													2,817 43	1,455 26					2,817 43	1,455 26	*Nil.*	60
61. St. Paul Fire & Marine Insurance Co.							4,553 60	1,223 49							24,925 79	*Nil.*	I.T. 24 25	*Nil.*	29,503 64	1,223 49	34 15	61
62. Scottish Union & National Insurance Co.							4,697 86	1,035 20									S.L. 87 50	*Nil.*	4,685 36	1,035 20	634 00	62
63. Standard Marine Insurance Co., Ltd.															29,001 14	23,433 60			29,001 14	23,433 60		63
64. Tokio Marine & Fire Insurance Co., Ltd.															8,144 56	*Nil.*			8,144 56	*Nil.*	3,840 00	64
65. Travelers Indemnity Co.	1,043 49	114 00	2,165 54	*1,524 57															3,209 03	1,638 57	*Nil.*	65
66. Travelers Insurance Co.	5,803 69	259 39																	5,803 69	259 39	*Nil.*	66
67. Union Insurance Society of Canton, Ltd.							† 2,146 16	1,182 75							37,598 26	10,102 97			39,744 42	11,285 72	*Nil.*	67
68. Union Marine Insurance Co.							7,580 05	2,338 39							2,241 70	73 67			9,821 75	2,412 06	1,400 00	68
69. United States Fidelity & Guaranty Co.	780 50	53 57	535 00	760 67	2,431 66	170 35	1,427 38	245 93	847 57	*Nil.*	7,807 86	142 17	1,337 67	858 24					15,167 64	2,230 93	8,532 00	69
70. Western Assurance Co.							1,497 35	*Nil.*							10,657 67	9,179 91	I.T. 787 01	248 85	12,942 03	9,428 76	2,500 00	70
71. World Marine & General Insurance Co.															11,252 64	4,936 15			11,252 64	4,936 15	146 58	71
72. Yang Tsze Insurance Association, Ltd.															11,834 49	2,403 86			11,834 49	2,403 86	1,760 50	72
73. Yorkshire Insurance Co., Ltd.	94 00		95 00	60 75	189 00	*Nil.*							215 25	35 00			L.S. 175 05	*Nil.*	768 30	95 75	75 00	73
	$221,568 38	$ 78,622 97	$ 73,523 55	$ 41,807 03	$ 31,339 80	$ 14,508 01	$230,344 54	$ 65,287 08	$ 3,292 61	*Nil.*	$ 37,302 15	$ 4,215 35	$ 34,289 11	$ 17,136 49	$405,674 50	$132,967 29	$ 4,740 93	$ 251 35	$1,041,975 57	$357,795 57	$149,955 02	

*Accident and sickness.

RETURNS TO DECEMBER 31ST, 1918, OF PROVINCIAL LICENSEES OTHER THAN FIRE AND MARINE INSURANCE COMPANIES.

ASSETS.

Name of Company.	Real Estate.	Mortgages.	Bonds, Stocks, and Loans.	Interest accrued.	Outstanding Premiums and Agents' Balances.	Cash in Office or on Deposit.	All other Assets.	Total.
1. British Columbia Plate Glass Insurance Co.	.....	.....	$ 14,130 68	.....	$ 2,474 48	$ 1,174 84	$ 35 00	$ 17,815 00
2. Great North Insurance Co.	.....	$ 7,300 00	40,672 37	.....	22,123 95	58,760 13	7,479 65	136,336 10
3. Royal Plate Glass Insurance Co.	$ 2,250 00	.....	7,000 00	$ 64 83	202 37	323 76	732 66	10,573 62
4. Western Empire Life Assurance Co.	15,125 35	93,356 84	124,432 66	9,948 26	57,346 06	15,052 69	63,990 45	379,252 31
Totals.	$17,375 35	$100,656 84	$186,235 71	$10,013 09	$82,146 86	$75,311 42	$72,237 76	$543,977 03

LIABILITIES.

Name of Company.	Unpaid Losses.	Unearned Premiums.	Other Reserves.	Other Liabilities.	Total except Paid-up Capital.	Capital Stock paid up.	Total including Paid-up Capital.
1. British Columbia Plate Glass Insurance Co.	.....	$ 12,765 30	.....	.....	$ 12,765 30	$ 3,840 00	$ 16,605 30
2. Great North Insurance Co.	$ 7,833 85	40,145 54	.....	$15,667 67	63,647 06	46,731 24	110,378 30
3. Royal Plate Glass Insurance Co.	.....	2,711 36	.....	673 18	3,384 54	2,750 00	6,134 54
4. Western Empire Life Assurance Co.	28,467 53	190,651 00	.....	44,279 40	263,397 93	134,448 85	397,846 78
Totals	$36,301 38	$246,273 20	.....	$60,620 25	$343,194 83	$187,770 09	$530,964 92

RECEIPTS.

Name of Company.	Premiums.	Interest.	Calls on Capital Stock.	All other Receipts.	Total.
1. British Columbia Plate Glass Insurance Co.	$ 12,306 44	$ 776 27	.....	$ 388 47	$ 13,471 18
2. Great North Insurance Co.	231,280 91	3,830 51	$ 7,931 78	.....	243,043 20
3. Royal Plate Glass Insurance Co.	2,817 43	614 90	.....	.....	3,432 33
4. Western Empire Life Assurance Co.	82,274 67	17,765 29	2,782 30	2,503 85	105,326 11
Totals.	$328,679 45	$22,986 97	$10,714 08	$2,892 32	$365,272 82

EXPENDITURE.

Name of Company.	Expenses of Management.	Losses paid.	Dividends.	All other Expenditures.	Total.
1. British Columbia Plate Glass Insurance Co.	$ 5,005 21	$ 7,382 81	.....	.....	$ 12,388 02
2. Great North Insurance Co.	128,367 59	84,108 80	$5,643 75	$1,131 22	219,251 36
3. Royal Plate Glass Insurance Co.	972 14	1,450 26	.....	32 40	2,454 80
4. Western Empire Life Assurance Co.	65,143 18	18,218 75	775 93	1,448 00	85,585 86
Totals.	$199,488 12	$111,160 62	$6,419 68	$2,611 62	$319,680 04

PERSONAL NEGLIGENCE NOW CRIMINAL OFFENCE.

An Act to amend the Criminal Code respecting prevention of fire was passed by the Senate on April 8th and House of Commons on April 23rd, 1919, and reads as follows:—

"His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

"1. Section 515 of the Criminal Code is amended by inserting the following subsection immediately before subsection (2) thereof:—

"(1*a*.) Every one is guilty of an indictable offence and liable to two years' imprisonment who by negligence causes any fire which occasions loss of life or loss of property.

"The person owning, occupying, or controlling the premises in which such a fire occurs, or on which such fire originates, shall be deemed to have caused the fire through negligence if such person has failed to obey the requirements of any law intended to prevent fires or which requires apparatus for the extinguishment of fires, or to facilitate the escape of persons in the event of fire, if the jury finds that such fire, or the loss of life, or the whole or any substantial portion of the loss of property, would not have occurred if such law had been complied with.

"2. The said Act is further amended by inserting immediately after section 515 the following section:—

"515A. When any Dominion, Provincial, or municipal fire officer or authority recommends to the owner, lessee, or other person controlling or operating any building, structure, factory, shipyard, vessel, dock, wharf, pier, sawmill, or yard in which logs or lumber are stored or held, that any reasonable change, alteration, or addition should be made in or to such building, structure, factory, shipyard, vessel, dock, wharf, pier, sawmill, or yard with a view to safeguarding life or property from destruction by fire, or that any material should be removed therefrom with such view, or that any apparatus should be supplied therefor with such view; and if such recommendation is approved by an officer in the service of His Majesty, thereto authorized by the Governor in Council; and if notice of such recommendation and approval has been personally served upon such owner, lessee, or other person; and if, after the expiration of thirty days from the receipt of such notice, such owner, lessee, or other person refuses, neglects, or otherwise fails to carry out such recommendation to the satisfaction of the officer in the service of His Majesty hereinbefore mentioned, such owner, lessee, or other person shall be guilty of an indictable offence, and shall be liable to a fine of not exceeding one thousand dollars, or to imprisonment for any term not exceeding six months, or to both such fine and imprisonment."

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VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

THE

UNIVERSITY OF BRITISH COLUMBIA

VANCOUVER, B.C.

BALANCE-SHEET AND STATEMENT

OF

RECEIPTS AND DISBURSEMENTS

AS AT

MARCH 31ST, 1919

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty,
1919.

To His Honour Sir Frank Stillman Barnard, K.C.M.G.,

Lieutenant-Governor of the Province of British Columbia.

May it please Your Honour:

I beg herewith respectfully to present the Financial Statement of the University of British Columbia for the year ending March 31st, 1919.

J. D. MacLEAN,

Minister of Education.

May 7th, 1919.

VANCOUVER, B.C., May 3rd, 1919.

The Hon. J. D. MacLean, M.D., C.M.,
Minister of Education, Victoria, B.C.

SIR,—At the meeting of the Board of Governors held on April 28th the Financial Statement for the fiscal year ending March 31st, 1919, was presented, and it was ordered that copies be sent to you, together with the explanatory letter prepared by the Bursar.

Yours very truly,

L. S. KLINCK,
Acting-President.

UNIVERSITY OF BRITISH COLUMBIA.

BALANCE-SHEET AND STATEMENT OF RECEIPTS AND DISBURSEMENTS.

VANCOUVER, B.C., April 28th, 1919.

The Chancellor and Board of Governors,
The University of British Columbia,
Vancouver, B.C.

DEAR SIRS,—I beg to submit the following annual statements for your approval:—

Balance-sheet as at March 31st, 1919, and statement of receipts and disbursements for the period from July 1st, 1918, to March 31st, 1919.

UNIVERSITY SITE.

Since the last annual statement (June 30th, 1918) the sum of $4,294.71 was expended on sewer, extending electric-light line, water-piping, surveying, etc., on the University site at Point Grey.

BUILDINGS.

During the same period the poultry colony houses and fencing were erected at Point Grey at a cost of $3,599.02. The dairy, dairy-barn, bull-pen, and two foremen's cottages were completed under last year's contract at an expenditure of $12,536.49, making a total cost for these buildings of $23,825.59. The hay-barn and feed-store at Point Grey was also completed under contract at a cost of $5,559. This makes the total expenditure on buildings at Point Grey for the nine months ending March 31st, 1919, $21,694.51.

PROVINCIAL GOVERNMENT GRANTS.

The Provincial Government granted to the University the sum of $220,000 for the period from April 1st, 1918, to March 31st, 1919. A supplemental grant for $46,000 and a special grant towards buildings and maintenance of Forest Products Laboratory of $2,500 were also received, making total grants of $268,500 from the Provincial Government. Of this amount, the sum of $36,666.66 was received prior to June 30th, 1918, leaving the sum of $231,833.34 as the net Provincial Government grants received from July 1st, 1918, to March 31st, 1919.

Under the Dominion "Agricultural Instruction Act," I understand the Provincial Government were to receive from the Dominion Government the sum of $69,199.06, of which $8,000 was the amount allotted to the University for agricultural instruction throughout the Province. No payment has been received by the University on this account, although the sum of $1,027.50 has been expended by the University up to and including March 31st, 1919.

SCHOLARSHIPS.

The Royal Institution for the Advancement of Learning of British Columbia presented the University with eight Victory War Loan bonds for $1,000 each, bearing interest at 5½ per cent. per annum and maturing December 31st, 1922, as an endowment for the McGill Graduates' Scholarship of $2,500, the Shaw Memorial Scholarship of $2,500, and the Dunsmuir Scholarship of $3,000.

CO-OPERATIVE SEED-GROWING.

The amount received from the Dominion Government on this account for the nine months ending March 31st, 1919, was $1,062.41, of which the sum of $954.01 was expended, leaving a balance to the credit of this work of $108.40, plus a balance of $9.34 carried over from the previous year.

DEPRECIATION.

Ten per cent. depreciation, amounting to $81,776.79, has been allowed on buildings and equipment—this amount being added to general expenditures.

FIRE INSURANCES.

The amount of fire insurance in force at March 31st, 1919, was $187,135, distributed as follows:—

University buildings at Point Grey	$20,000 00	
„ „ at Fairview	58,500 00	
		$78,500 00
Vocational buildings at Point Grey	$ 9,800 00	
„ „ at Fairview	14,800 00	
	24,600 00	
		$103,100 00
Library books, etc.		40,100 00
Equipment		43,935 00
Total		$187,135 00

Unexpired fire insurance premiums at March 31st, 1919, amount to $3,299.67, and this has been shown on the balance-sheet as an asset of the University.

BOOK-STORE (STUDENTS' TEXTS).

Text-books to the amount of $5,834.40 were sold to students, showing a profit of $831.13, equal to 16½ per cent. The stock in hand amounts to $2,706.66, as against $1,305.85 the previous year. This is accounted for through the fact that after ordering and receiving texts new heads of departments were appointed in English and History, who changed certain of the text-books for the year. I am informed that these texts will be used to a large extent next year.

PRODUCE AND LIVE STOCK.

Produce and live stock amounting to $3,400.76 was sold during the period July 1st, 1918, to March 31st, 1919, and credited to general expenditures. Details of this appear in statement of receipts.

DEPARTMENT OF SOLDIERS' CIVIL RE-ESTABLISHMENT.

For the period July 1st, 1918, to March 31st, 1919, the University has disbursed for buildings, salaries, supplies, and equipment for the above department the sum of $84,795.91. From July 1st, 1918, to January 31st, 1919, this was operated through the University bank account, but owing to the delay in receiving remittances from the Dominion Government, it was found that the financing of this department seriously affected the credit of the University bank account. It was therefore decided to open a special bank account on January 31st, 1919, thereby enabling us to finance within our Budget.

Your obedient servant,

F. DALLAS,

Bursar.

BALANCE-SHEET AS AT MARCH 31ST, 1919.

LIABILITIES.

Accounts payable—		
Estimated expense of examinations, April, 1919, and June, 1919		$ 2,400 00
Materials ordered not yet delivered; supplies, equipment, etc., estimated at (*see* Contra)		16,421 00
Balance of contract and architects' fees for dairy, dairy-barn, bull-pen, two cottages, etc. at Point Grey		226 44
Students' caution-money for Session 1918-19	$2,517 50	
Alma Mater fees, Session 1918-19	72 00	
		2,589 50
Photographic work done for departments		45 45
Carried forward		$ 21,682 39

LIABILITIES—*Continued.*

Brought forward			$ 21,682 39
Grants from Provincial Government of B.C. (for period from 1910 to 1919)—			
Site for the University, Point Grey, at nominal value		$ 1 00	
Gift of museum collection, growing plants, records, etc., at nominal value		20,000 00	
Amount disbursed direct by Government		48,407 73	
Amount received by Governors of the University for general purposes to year 1916	$354,600 65		
Amount received by Governors of the University, year 1916-17	200,000 00		
Amount received by Governors of the University, year 1917-18	225,000 00		
Amount received by Governors of the University, year 1918-19 (Vote No. 175)	220,000 00		
Supplemental vote received by Governors, year 1918-19 (Special Warrant No. 48)	46,000 00		
Special grant towards building and maintenance of Forest Products Laboratory, year 1918-19 (Special Warrant No. 14)	2,500 00		
		1,048,160 65	
Amount received by Governors of the University for the completion of the Science Building, Point Grey		69,524 00	
Amount expended	$ 60,586 42		
Amount held in trust (unexpended)	8,937 58		
			1,186,093 38
Gifts from individuals of equipment, books, etc., valued at			5,000 00
Faculty contributions to University Extension Courses, less amount expended			14 95
Balance of co-operative seed-growing funds			117 74
Department of Soldiers' Civil Re-establishment—Equipment, gasolene, oil, etc., sold			865 03
Trusts—			
Royal Institution for the Advancement of Learning of British Columbia Students' Loans and Scholarships Fund (established August, 1915)		$ 32,059 45	
Annual sum required to be available for scholarships and loans under the above—			
1915-16	$1,600 00		
1916-17	1,600 00		
1917-18	1,600 00		
	$4,800 00		
(Of this sum $550 is on loan to students.)			
Less scholarships paid	2,000 00		
		2,800 00	
Amount voted by Board of Governors for scholarships and prizes—			
1916-17	$ 830 00		
1917-18	830 00		
	$1,660 00		
Less scholarships and prizes paid $1,380 00			
„ book prizes 49 68			
	1,429 68		
		230 32	
Carried forward		$ 35,089 77	$1,213,773 49

LIABILITIES—*Concluded.*

Brought forward		$ 35,089 77	$1,213,773 49
Scholarship presented by the Chancellor, Dean Robinson, and Judge Howay	$ 75 00		
Less scholarship paid	75 00		
Shaw Memorial Scholarship, 1918-19	$ 137 50		
Less amount paid	91 65		
		45 85	
Royal Institution for the Advancement of Learning of B.C.—			
The McGill Graduates' Scholarship		2,500 00	
The Shaw Memorial Scholarship		2,500 00	
The Dunsmuir Scholarship		3,000 00	
Students' fees returnable		8 00	
Held for creditors, Science Building contract		11 32	
Contractors' deposits with tenders		2,403 50	
			45,558 44
			$1,259,331 93

ASSETS.

Site for University—			
Granted by Provincial Government, comprising Lots 3044, 3045, 3045A, 4804, 4805, 4806, and 4807, Group 1, N.W.D. ("British Columbia University Site Act, 1911," Amendments 1913 and 1918), at nominal value		$ 1 00	
Add: Expenditure for surveying, clearing, grading, etc., to June 30th, 1918		98,511 32	
Expenditure for period from July 1st, 1918, to March 31st, 1919		4,294 71	
			$ 102,807 03
Buildings and works—			
Including general plans, Science Building under construction, docks, etc., at cost to June 30th, 1915		$ 80,809 77	
Expenditure for year ending June 30th, 1916		35,225 28	
		$ 116,035 05	
Horticultural storage-barn, Point Grey, at cost		5,053 97	
Dairy, dairy-barn, bull-pen, manure-tank, and two cottages at Point Grey, at cost		23,825 59	
Hay-barn and feed-store at Point Grey, at cost		5,559 00	
Poultry colony houses and fencing, Point Grey, at cost		3,559 02	
		$ 154,072 63	
Temporary buildings erected at Hospital site, 1915, at cost	$23,523 95		
Temporary buildings taken over from McGill University at valuation, Hospital site	17,379 85		
Temporary buildings erected at Hospital site, 1916, at cost	39,205 11		
		80,108 91	
		$ 234,181 54	
Less depreciation allowed to March 31st, 1919		57,834 51	
			176,347 03
Carried forward			$ 279,154 06

ASSETS—*Continued.*

Brought forward			$ 279,154 06
Equipment—			
Furniture, Administration and Departmental Offices, specimens, etc., at cost to June 30th, 1915	$ 6,029 81		
Taken over from McGill University College at valuation	12,769 60		
Purchased from July 1st, 1915, to March 31st, 1919	74,894 86		
	$ 93,694 27		
Less depreciation allowed to March 31st, 1919	23,942 28		
	$ 69,751 99		
Museum collection—			
Growing plants, records and equipment, a gift from the Provincial Government, valued at	20,000 00		
Gifts to Departments of Geology and Physics	1,000 00		
			90,751 99
Library books—			
Distributed as to departments at cost in Vancouver to June 30th, 1915	$ 25,407 80		
Gifts of books to Library, valued at	4,000 00		
Taken over from McGill University College at valuation	1,910 00		
Purchased from July 1st, 1915, to March 31st, 1919	15,737 96		
			47,055 76
Live stock—			
Department of Agriculture (one team of horses)	$ 625 00		
„ Horticulture (one team of horses)	700 00		
„ Animal Husbandry (cattle and hogs)	6,855 27		
„ Poultry Husbandry (poultry)	594 52		
			8,774 79
Book-store—			
Students' text-books on hand at March 31st, 1919			2,706 66
Supplies on hand at March 31st, 1919			3,500 00
Sundry accounts receivable—			
Convocation expenses, 1912-13	$ 437 85		
Corporation of Point Grey, water-mains	17,989 38		
Competition premium, architects' plans (balance)	3,500 00		
Burrell grant, amount expended to March 31st, 1919	1,027 50		
			22,954 73
Department of Soldiers' Civil Re-establishment—			
For sundry expenditures during March, 1919			614 13
Materials ordered not yet delivered (*see* Contra)			16,421 00
Unexpired insurance premiums at March 31st, 1919			3,299 67
Trusts—			
Royal Institution for the Advancement of Learning of B.C., eight Victory War Loan bonds, Nos. V044139-46M, for $1,000 each, bearing interest at 5½ per cent. per annum, maturing December 1st, 1922; being endowment for the McGill Graduates, Shaw Memorial, and Dunsmuir Scholarships		$ 8,000 00	
Held in trust in Bank of Montreal, Trust Accounts Nos. 1 and 2—			
Royal Institution for the Advancement of Learning of B.C. Students' Loans and Scholarships Fund, less disbursed	$ 2,250 00		
University scholarship and prizes, less disbursed	230 32		
Shaw Memorial Scholarship, less disbursed	45 85		
Students' fees returnable	8 00		
Carried forward	$ 2,534 17	$ 8,000 00	$ 475,232 79

ASSETS—*Concluded.*

Brought forward	$ 2,534 17	$ 8,000 00	$ 475,232 79
Trusts—*Concluded.*			
Held for sundry creditors, R. McLean & Co., contract *re* Science Building, Point Grey	11 32		
Special fund for completion of Science Building, Point Grey	8,937 58		
Contractors' deposits with tenders	2,403 50		
	$13,886 57		
Trust funds to be repaid (students' loans)	550 00		
		14,436 57	
			22,436 57
Balance in Bank of Montreal—			
General Current Account		$ 36,070 94	
Bursar's Account	$500 00		
Balance, cash in hand, Bursar's Account	79 69		
		579 69	
		$ 36,650 63	
Balance in Bank of Montreal, Special Account, co-operative seed-growing		117 74	
			36,768 37
General expenditures, including administration and departmental salaries, supplies, travelling and other expenses, telephones, fuel and heat, power, light, water rates, fire-insurance premiums, maintenance and repairs of buildings, depreciation on buildings and equipment, examination expenses, etc. (including McGill University College grant, $10,000)—			
To June 30th, 1915		$ 66,496 31	
From July 1st, 1915, to March 31st, 1919		658,397 89	
			724,894 20
			$1,259,331 93

SUMMARY STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR THE PERIOD FROM JULY 1ST, 1918, TO MARCH 31ST, 1919.

1918.			
July 1st. Balance in Bank of Montreal—			
Trust Account No. 1		$ 11,142 65	
Trust Account No. 2		1,612 10	
Bursar's Account		500 00	
Special Account		9 34	
		$ 13,264 09	
Cash in hand, Bursar's Account		129 17	
Carried forward			$ 13,393 26

RECEIPTS.

Brought forward				$ 13,393 26
Provincial Government grant—				
Vote for Session 1918-19 for general University purposes, April 1st, 1918, to March 31st, 1919 (Vote No. 175)		$220,000 00		
Less amount received as at June 30th, 1918, and included in statement of June 30th, 1918		36,666 66		
		$183,333 34		
Supplemental vote for general University purposes, Session 1918-19, April 1st, 1918, to March 31st, 1919 (Special Warrant No. 48)		46,000 00		
Special grant towards building and maintenance of Forest Products Laboratory, Session 1918-19, April 1st, 1918, to March 31st, 1919		2,500 00		
			$ 231,833 34	
Fees received from students—				
Examinations for University, year 1918-19—				
Supplementals		$ 477 00		
Matriculation	$408 50			
Less fees returned	20 00			
		388 50		
Sessional registration fees, year 1918-19	$4,806 00			
Less fees returned	116 00			
		4,690 00		
Agricultural Short Course fees, year 1918-19		143 00		
Mining Short Course fees, year 1918-19		20 00		
Special fees—				
Late fees	$232 00			
Less fees returned	2 00			
	$230 00			
Special examinations	$ 67 50			
Less fees returned	7 50			
	60 00			
Rereading examination papers	6 00			
Duplicate certificates and examining documents	29 00			
		325 00		
			6,043 50	
Students' caution-money (returnable)		$ 2,660 00		
Less amount refunded as at March 31st, 1919		142 50		
			2,517 50	
Alma Mater fees collected for Alma Mater Society		$ 1,964 00		
Less amount refunded to Alma Mater Society at March 31st, 1919		1,892 00		
			72 00	
Scholarships—				
Second Year Arts Scholarship presented by the Chancellor, Dean Robinson, and Judge Howay		$ 75 00		
Shaw Memorial Scholarship, one year's interest on endowment		137 50		
			212 50	
Produce and live stock sold—				
Department of Horticulture		$ 514 26		
Carried forward		$ 514 26	$ 240,678 84	$ 13,393 26

RECEIPTS—*Concluded.*

Brought forward	$ 514 26	$ 240,678 84	$ 13,393 26
Produce and live stock sold—*Concluded.*			
Department of Animal Husbandry—			
Live stock	$1,387 00		
Dairy produce	1,064 54		
	2,451 54		
Department of Poultry Husbandry	434 96		
		3,400 76	
Rebate on purchase price of team of horses from J. Hanbury & Co., Department of Agriculture		25 00	
Interest earned on Trust Accounts for six months ending December, 1919		99 50	
Photographic Account—			
Amount due for labour	$ 45 45		
Sales Account	8 58		
		54 03	
Contribution by the late President Wesbrook to current expenses of the University		1,000 00	
Faculty contributions to University Extension Courses	$ 63 00		
Less amount expended as at March 31st, 1919	48 05		
		14 95	
Contractors' deposits with tenders (returnable)—			
S. N. McLeod (garage, machine-shop, and Commercial Building)	$ 2,887 50		
Wm. Mason (cafeteria, blacksmith-shop, etc.)	425 10		
		3,312 60	
Department of Soldiers' Civil Re-establishment—			
Amount outstanding at June 30th, 1918 (*see* June 30th, 1918, statement)	$ 5,014 21		
Gasolene, oil, and repairs to automobiles	558 03		
		5,572 24	
Co-operative seed-growing—			
Amount received from Dominion Government	$ 1,062 41		
Less amount expended as at March 31st, 1919	954 01		
		108 40	
Total receipts			254,266 32
			$ 267,659 58

1918.

July 1st. Overdraft, Bank of Montreal, General Current Account ..... $ 8,377 30

DISBURSEMENTS.

Buildings and works—			
Poultry colony houses and fencing at Point Grey	$ 3,599 02		
Dairy-barn, dairy, bull-pen, and two cottages at Point Grey	12,536 49		
Hay-barn and feed-store at Point Grey	5,559 00		
Box-drain sewer at Point Grey	1,497 25		
Extending electric-light line at Point Grey	2,250 00		
			25,441 76
Water-pipe at Point Grey (Department of Agriculture)	$ 200 46		
Surveying and architects' fees at Point Grey (Department of Administration)	347 00		
			547 46
Carried forward			$ 34,366 52

DISBURSEMENTS—*Continued.*

Brought forward		$ 34,366 52
Contractors' deposits with tenders—		
Layfield & Tardiff, account dairy, dairy-barn, etc.	$ 1,000 00	
S. N. McLeod, account garage, machine-shop, and Commercial Building	1,527 00	
Wm. Mason, account cafeteria, blacksmith-shop, etc.	425 10	
		2,952 10
Live stock, Department of Poultry Husbandry		594 52
Library books, magazines, etc.		3,676 92
Students' text-books—		
Text-books purchased	$ 6,404 08	
Text-books sold	5,834 40	
		569 68
Robert McLean Co. creditors, wages uncalled for at March 31st, 1919		3 45
Students' caution-money, Session 1917-18, amount refunded		3 10
Students' scholarships and prizes—		
Scholarships (Royal Institution)	$ 750 00	
„ (University)	525 00	
„ (presented by the Chancellor, Dean Robinson, and Judge Howay)	75 00	
„ (Shaw Memorial)	91 65	
Fellowship (University)	200 00	
Prizes, books (University)	36 99	
		1,678 64
Burrell grant (Dominion "Agricultural Instruction Act")		1,027 50
Department of Soldiers' Civil Re-establishment—		
Department of Mechanical Engineering	$ 323 60	
„ Mining	129 10	
„ Horticulture	17 98	
„ Agriculture (General)	17 63	
Garage, machine-shop, and Commercial Building	84 77	
Vocational Building, smithy, and carpenter-shop	27 18	
Cafeteria, blacksmith-shop, etc.	13 87	
		614 13
Salaries—		
Administration, including President, Deans, and Assistants	$ 10,400 81	
Department of Agronomy	7,470 00	
„ Animal Husbandry	5,112 21	
„ Horticulture	4,862 46	
„ Poultry Husbandry	2,587 50	
„ Dairying	2,354 80	
„ Bursar	3,858 00	
„ Buildings and Grounds (Janitors)	4,081 00	
„ Bacteriology	1,197 44	
„ Botany and Zoology	2,362 44	
„ Botanical Gardens	3,025 00	
„ Chemistry	8,885 90	
„ Civil Engineering	2,615 00	
„ Classics	4,574 96	
„ Economics	2,250 00	
„ English	5,829 15	
„ Geology and Mineralogy	4,896 35	
„ History	1,310 73	
„ Library	3,645 00	
„ Mathematics	7,061 13	
Carried forward	$ 88,379 88	$ 45,486 56

DISBURSEMENTS—*Continued.*

Brought forward	$ 88,379 88	$ 45,486 56	
Salaries—*Concluded.*			
Department of Mechanical Engineering	3,778 00		
" Mining	2,817 59		
" Modern Languages	6,779 21		
" Military (C.O.T.C.)	300 00		
" Philosophy	2,025 00		
" Physics	5,648 32		
" Registrar	2,402 00		
		112,130 00	
Furniture and equipment—			
Department of Administration	$ 685 26		
" President's Office	20 58		
" Agronomy	311 78		
" Agriculture (General)	1,673 88		
" Animal Husbandry	561 32		
" Horticulture	681 22		
" Poultry Husbandry	368 08		
" Dairying	264 79		
" Bursar	149 50		
" Photography	129 29		
" Bacteriology	527 22		
" Botany and Zoology	2,049 48		
" Botanical Gardens	90 80		
" Chemistry	2,288 69		
" Civil Engineering	18 00		
" Economics	12 17		
" English	19 94		
" Geology and Mineralogy	2,950 17		
" Library	595 34		
" Mathematics	57 17		
" Mechanical Engineering	685 01		
" Forest Products Laboratory	350 14		
" Mining	524 94		
" Military (C.O.T.C.)	15 70		
" Physics	557 18		
" Registrar	104 41		
		15,692 06	
Supplies—			
Department of Administration	$ 249 52		
" President's Office	2 20		
" Agronomy	179 15		
" Agriculture (General)	301 88		
" Animal Husbandry	260 67		
" Horticulture	563 52		
" Poultry Husbandry	674 55		
" Dairying	157 48		
" Bursar	227 09		
" Bacteriology	261 29		
" Botany and Zoology	445 87		
" Botanical Gardens	285 35		
" Chemistry	1,174 83		
" Civil Engineering	8 40		
" Classics	62 57		
" Economics	11 78		
Carried forward	$ 4,866 15	$ 173,308 62	

DISBURSEMENTS—*Continued.*

Brought forward		$ 4,866 15	$ 173,308 62
Supplies—*Concluded.*			
Department of English		14 00	
„ Geology and Mineralogy		430 05	
„ History		65 75	
„ Library		554 12	
„ Mathematics		14 74	
„ Mechanical Engineering		303 33	
„ Mining		143 53	
„ Modern Languages		59 42	
„ Military (C.O.T.C.)		10 90	
„ Physics		378 00	
„ Registrar		493 63	
			7,333 62
Expenses—			
Department of Administration, including scholarships and prizes held in trust, President's house allowance, travelling expenses, telegrams, postages, freights, express, etc.	$7,028 77		
Less trust funds for scholarships and prizes transferred from Current Account to Trust Account No. 2	2,430 00		
		$ 4,598 77	
Department of President's Office		26 75	
Department of Agronomy, including preparation of land for experimental purposes at Point Grey, seeds, fertilizers, freights, travelling expenses, etc.		4,599 64	
Department of Agriculture (General), including preparation of land for experimental purposes at Point Grey, freights, maintenance of motor-truck and automobile, telegrams, postages, etc.		6,072 84	
Department of Animal Husbandry, including travelling expenses, feed for cattle and hogs, wages at Point Grey, freights, express, telegrams, and postages		5,760 72	
Department of Horticulture, including travelling expenses, seeds and fertilizers, feed for team, wages at Point Grey, freights, express, telegrams, and postages		5,316 04	
Department of Poultry Husbandry, including travelling expenses, wages at Point Grey, freights, express, telegrams, postages, etc.		1,037 53	
Department of Dairying, including travelling expenses, freights, express, telegrams, postages, etc.		404 13	
Department of Bursar, including telephones, fuel and heat, power, light, water rates, fire-insurance premiums, freights, express, telegrams, postages, etc.		5,742 34	
Department of Buildings (repairs and maintenance)		985 63	
Department of Physical Examinations		565 29	
Department of Examination Expense		1,252 72	
			36,362 40
Total disbursements			$ 217,004 64

DISBURSEMENTS—*Concluded.*

Brought forward		$ 217,004 64
Balances—Cash at March 31st, 1919—		
Bank of Montreal—		
General Current Account	$ 36,070 94	
Trust Account No. 1	11,352 40	
Trust Account No. 2	2,534 17	
Bursar's Account	500 00	
	$ 50,457 51	
Cash in hand, Bursar's Account	79 69	
	$ 50,537 20	
Bank of Montreal, Special Account (co-operative seed-growing)	117 74	
		50,654 94
		$ 267,659 58

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